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Washington Highlights

The valedictory of the Petroleum Administration for War was presented during the last week in November to the O'Mahoney Petroleum Investigating Committee, as that government war agency readied itself for relegation to the junk heap on December 31.

The final presentation to Congress made by the PAW featured an opening and closing statement by Ralph K. Davies of California, Deputy Administrator of the PAW, a talk by Harold L. Ickes, Secretary of the Interior, and top man in the PAW, and the submission of lengthy studies on the various phases of the PAW's war effort by ten other officials of the war time agency.

Davies called for legislation exempting the oil industry from provisions of the anti-trust laws which might prevent oil companies from entering into mutual agreements for the conservation of petroleum resources and products.

He pointed out that many operators today hesitate to join in a voluntary conservation program because of fear of prosecution under the anti-trust laws, and pointed to the suits instituted by the Department of Justice a few years ago as an example of what might be expected unless relief is forthcoming.

Ickes urged the adoption of a four-point program for increased exploration, technological advances, a more efficient utilization of reserves, and the assurance to the United States of access to foreign oil reserves.

Opening the PAW's swan song before the Senate Committee, Davies made the first official request for extensive post-war legislation in the oil industry, with five major recommendations. In addition to relief from provisions of the anti-trust laws, he specifically requested:

1. An increase in the price of crude as "the most effective stimulus" to increased discovery rates and to encourage wildcat drilling. During the past year, he explained, only one producing well was brought in to every four dry holes. To induce enough individual operators to face adverse odds of four to one, Davies said, the price of crude must be such that the man who makes even a small discovery can expect something more than a modest return.

2. Control by each state of the petroleum resources within its borders, and strong opposition to the extension of Federal regulatory authority unless all other means fail to prevent practices injurious to the national welfare and the citizens of other states. Davies said that eleven oil-producing states, headed by California, have no adequate oil conservation laws, and called for action by the legislatures of these states to remedy that defect.

3. Disposal of surplus war properties and facilities at prices which will permit the making of a reasonable operating profit to the buyer. On the question of what to do with the Big Inch and Little Inch pipelines, Davies said that this should be done under the theory that they have served their purpose, have more than repaid their cost in services rendered and "they need not be looked upon as owing us anything."

These lines were not built or needed to serve a peacetime economy and probably would have little use in any future war, he said.

4. Full participation by American oil companies in the development of petroleum deposits in foreign areas, with particular reference to the Middle East. For the sake of the American economy and of future American security, he said, nothing should be left undone to promote full participation by American interests in the development of the vast foreign oil-bearing areas.

Ickes urged the stockpiling of oil products both in the United States and at strategic points throughout the world as "elementary prudence" so that supplies will be available where and when we might need them.

The one-time bogeyman of the oil industry called for "continued understanding between government and industry" recognizing both private and public concern. He sharply criticized the setting up of Naval petroleum reserves with no similar provision for the Army or the Air Force.

"Is our Army of today supposed to run on oats and our Air Force on hay?" he asked. "What we need is a national policy, devoid of departmental acquisitiveness and having regard for the oil needs of the armed forces of the nation as a whole."

Ickes called for the "assistance and encouragement" of the United

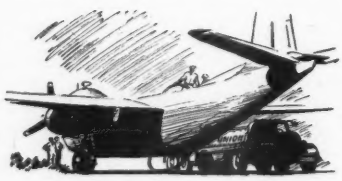
Flying Tigers fly strawberries now

1. 12 Flying Tigers, India-China "hump" pilots and A.V.G. ground crew men came home from the war with an idea. After what they'd learned in China, they thought they could carve out a place for themselves in the air freight business – not as a regularly scheduled line but as contract haulers.

2. They knew they'd need a lot more capital. But that didn't discourage them. They pooled the savings they had, drew up their plans and started beating the bush for backers. Eventually they lined up several Los Angeles businessmen to furnish the additional capital on a 50-50 basis – the veterans to operate the company.

3. With this capital they bought 8 new, twin-engine, Navy-designed "Conestoga" cargo planes from the Surplus Property Board. Then they set up offices at the Long Beach (Cal.) Municipal Airport, named their company the *National Skyway Freight Corp.* and started business August 1, 1945.

4. Today the "Flying Tiger Line" employs 40 men, 38 of them veterans. Its planes, each with a cargo capacity of 10,000 pounds, haul *anything,* from strawberries to penicillin, on a contract basis. They'll pick up freight *any time, anywhere* in the U.S. and deliver it *anywhere* in the world.



5. The company uses Union Oil Aviation Products. But that doesn't seem nearly as important to us as the fact that the boys were able to do what they did. It could hardly have happened under anything but the American "system."

6. Without the *profit incentive* the businessmen would not have put up the capital. Without the hope of gaining *financial independence,* the boys wouldn't have sweated out the problems of starting a business. Altogether, we think it's one of the greatest things that's happened since the war.

UNION OIL COMPANY
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This series, sponsored by the people of Union Oil Company, is dedicated to a discussion of how and why American business functions. We hope you'll feel free to send in any suggestions or criticisms you have to offer. Write: The President, Union Oil Company, Union Oil Bldg., Los Angeles 14, Calif.

AMERICA'S *FIFTH* FREEDOM IS FREE ENTERPRISE

States government in aiding our oil companies in their overseas operations to help them in contributing to world-wide "security and amity."

He vigorously denied charges that the Anglo-American oil agreement which he signed in London in September is in any way a cartel. It merely sets up an International Petroleum Commission to study problems of international trade in oil with no authority to order any one to do anything, he explained.

In his closing statement to the committee, Davies warned that gasoline, kerosene and fuel oil — the three types of fuel made from petroleum—will be of major importance to the economy and the defense of the country for many years to come.

Even the coming utilization of atomic energy will not end the need for oil and gas, he declared. He placed mastery of atomic fission on the same basis as the discovery of fire, the wheel, and the engine, but doubted that it would be more revolutionary than those discoveries.

While in time atomic energy may displace the use of distillate fuels for cooking and heating, Davies said, by that time, diesel and jet propulsion engines will probably use all the distillate fuels that refineries will make.

Davies also urged the elimination of price controls on petroleum products. Adequate supplies are now available and lifting of the controls would provide better distribution and more equitable distribution of petroleum components such as gasoline and kerosene, he said.

Davies urged the establishment of a permanent, instead of a special, senate petroleum committee and highly commended Senator Joseph C. O'Mahoney (Dem., Wyo.) for his chairmanship of the present special committee.

It has been proven during the past war, he said, that the petroleum industry and the government can work together in harmony, but added that there should be a reorganization or better integration among the 36 governmental agencies now concerned with petroleum matters.

Pointing out that during the past war the PAW operated under a letter from the President issued under his war powers and defining its duties, Davies urged that in any future possible war a regulatory body for the industry should be given adequate power by legislation to enforce its orders.

The Petroleum Industry War Council, a body formed within the industry to aid and assist the government-operated PAW, is scheduled to meet in Washington during the week of December 10 to discuss the formation of a permanent skeleton organization at top levels of the industry for discussion as to the solution of mutual problems during peace times.

* * *

Don't look for any action on the anti-trust suit brought by the Department of Justice against the American Petroleum Institute at any time soon.

Attorney General Tom C. Clark has ordered a hands-off stand until the current labor situation is cleared up.

* * *

With the Navy now in control and running the oil plants, Clark has decided that the oil companies are having a rough time as it is, and that the API will have its hands full for some time to come until a management-labor peace in the industry can be reached.

* * *

Russell B. Brown, general counsel of the Independent Petroleum Association of America, has launched a bitter attack on Sumner T. Pike, director of the Fuel Price Division of the Office of Price Administration, for his recent statement urging continuance of price control over petroleum products.

Pointing out that while rationing has been lifted, price control remains, Brown calls this a prevention of "freedom of action" within the industry.

Brown asserted that the oil industry has met all public demands when operating in a free economy, and said that any lack of heating oil or other products could only be blamed on extension of present price controls.

* * *

The Federal Trade Commission, in one of its most important cases in recent years, has refused to make any clarification of its order prohibiting the sale of gasoline to jobbers at a wholesale rate if the jobber engages in retail operations in competition with other jobbers.

The Commission ruled that any clarification of its order against Standard of Indiana must come from the courts rather than from the commission itself.

Request for clarification came from the Independent Petroleum Association on the grounds that the FTC order might have the effect of forcing thousands of small petroleum marketers out of business. Standard has already signified its intention of taking the matter to the United States Court of Appeals.

* * *

Further action on the Champlin pipeline case has been postponed by the Supreme Court pending the return of Associate Justice Robert H. Jackson from the Nuernburg war criminal trials.

The case is in the nature of a test as to whether pipelines owned and used by one company can be forced to comply with orders issued by the Interstate Commerce Commission.

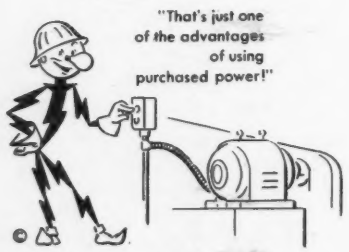
The ICC has ruled that the Champlin line which carries the company's products from Enid, Okla., to markets in Kansas and Iowa is a common carrier, and as such can be required to file rates with the commission and to the gasoline of competing refineries upon request. A decision either way by the Court would effect the entire system of pipelines throughout the United States.

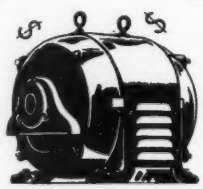
J. Barton Hutchins Joins Petrol Corp.

J Barton (Bart) Hutchins, who has been with the Oil Producers Agency for the past seven years, has resigned and has accepted a post with the Petrol Corp.

One of the best known oil men in California, Mr. Hutchins' work with the agency was centered chiefly on oil industry relations with the public. He represented the agency at Sacramento, during legislative days, each year.

electric pumping is profitable





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Air Cooling - Its Status and Possibilities

By KENNETH D. DEMAREST
The Griscom-Russell Co.

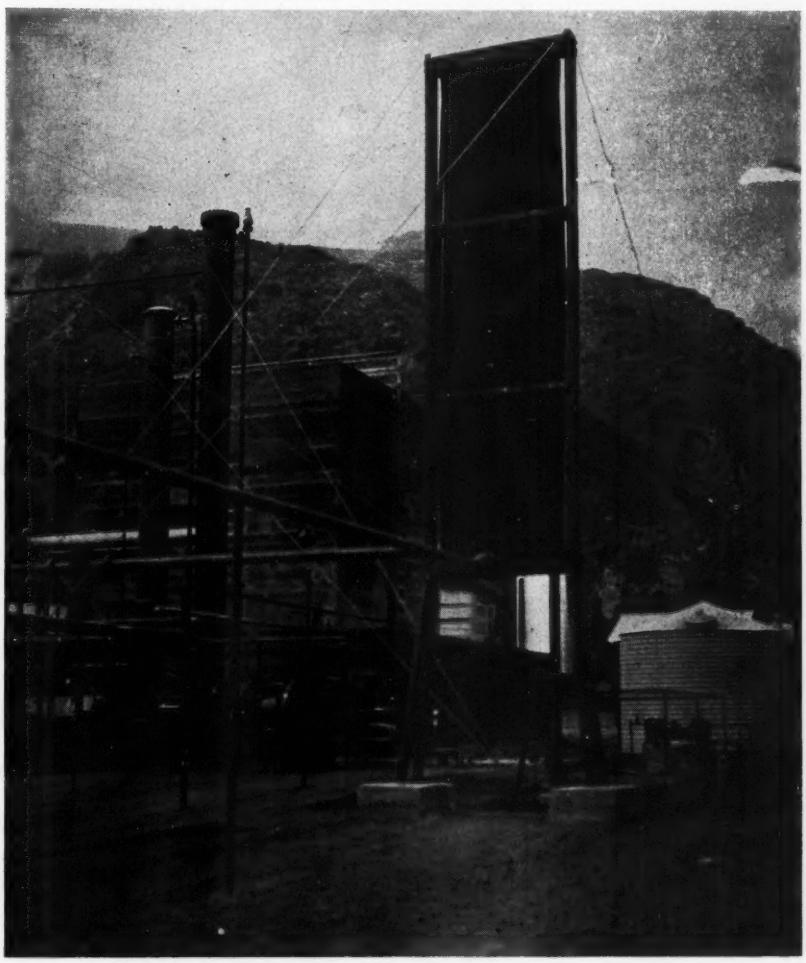
It is generally appreciated that modern civilization which is based upon highly integrated industrial development, an outgrowth of the industrial revolution, is largely due to the widespread release of energy on a huge scale. This is justly called an age of power, and it could certainly not have come to fruition without the availability of fuels, or, other sources of energy, such as water power, together with the mechanical and processing equipment to utilize them.

It is not so generally appreciated, however, that the corollary of this situation is the necessity of dissipating tremendous quantities of energy in the form of heat. It is safe to say that the one could not have come about without the other, and, that if economical means of cooling had not grown apace with the sources of power, the latter would have been severely limited in size and scope.

All cooling, in one form or another, generally occurs by dissipating heat to the atmosphere. Up to the present, water has generally been used to accomplish this end. The cooling effect is ultimately attained because atmospheric air is usually not saturated with water vapor, or humidity, and can therefore absorb more. Thus, if cooling water, obtained from a large body such as a river or bay, is passed through the condenser of a turbo-generator, being heated by so doing, and returned to its source at a higher temperature, the temperature of the body of water will rise. As soon as the temperature exceeds the dew point of the surrounding air, some of the water will evaporate, which limits the temperature it attains. The quantity of water which evaporates is usually small in comparison with that which the large volume of surrounding air can pick up. Also, fortunately, in most parts of the world, due to the effect of the seasons and other weather phenomena, the water is returned in the form of rainfall so that the supply, while varying, is maintained.

It is commonplace that most large scale plants, particularly for power generating, are located in the vicinity of an adequate supply of water. It is also commonplace that water, in general, is an excellent cooling medium because: (1) Both its specific and latent heats are relatively high, (2) it is chemically stable, (3) it is non-viscous in comparison with most other liquids, (4) it is non-toxic, and (5) as already mentioned, its supply is abundant.

After most things pass through the stage of development and attain widespread usage, the period of refinement follows. It has been evident for some time that this has been the case with water cooling. In areas where the water supply is limited, or expensive, or, where the requirements outrun even a generous supply, water cooling devices are more and more in evidence. First came the relatively inefficient and space devouring spray pond; next, the more efficient and compact natural draft cooling tower, both of which are dependent upon some wind velocity for performance. Lastly appeared the mechanical draft cooling tower which is still more compact, and since it is not dependent on the vagaries of the wind, provides closer control. The purpose of all these has been to reduce the quantity of water drawn from the surroundings to that re-



Early air-cooled exhaust steam condenser using natural draft installed in a casinghead gasoline plant.

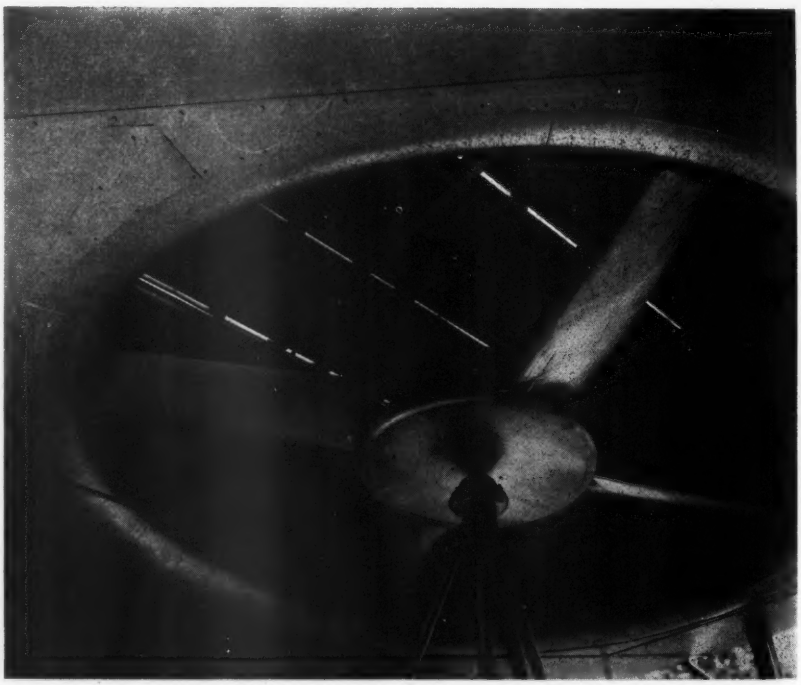
View of plenum chamber, fan and structure of a roof mounted air cooled unit, prior to installation of the heat transfer sections, which will close in the top.

quired to remove all heat by evaporation alone, plus small losses due to entrainment and windage, and blowdown of concentrated basin water.

While these served to reduce water requirements to a minimum, they did not alleviate other disadvantageous aspects of its usage. Most waters naturally contain various other foreign substances in solution and in suspension. These are commonly carbonates, chlorides, sulphates, and also silicates. Other contaminents are silt, slime, and general pollution in crowded, highly industrialized areas. An interesting aspect of such contamination is that, in cities where fly ash is discharged to the atmosphere in large quantities, it is picked up by cooling water when circulated through cooling towers. Also, water is biologically active, and will support the growth of fungi and algae.

Most users of water cooled equipment are familiar with the toll which is exacted due to the foregoing. First is the drop in efficiency of coolers and condensers caused by the resistance to heat flow of deposited scale, requiring oversized equipment involving additional investment in order to permit rated operation between cleaning periods. Together with this is the loss of investment return while the equipment is out of service for cleaning. Next is the deterioration of the equipment, due to the corrosive attack on such waters. Replacements are necessitated from time to time, requiring reinvestment of capital, as well as the labor expense involved and the loss of return on investment due to outage. To minimize these, water conditioning systems of various sorts are employed.

With the further development of oil and gas processing, and chemical operations, other problems have presented themselves. The materials generally employed for the tubes and tube sheets of water cooled equipment are non-ferrous alloys, as these have shown the longest life and least expense year in and year out. Generally these are suitable for use in contact with the fluids being cooled or condensed, provided metal temperatures are



Underneath view of an air-cooled unit, showing fan, fandrive, mechanical assembly and structure, roofed over by heat transfer sections.

maintained within well understood limits.

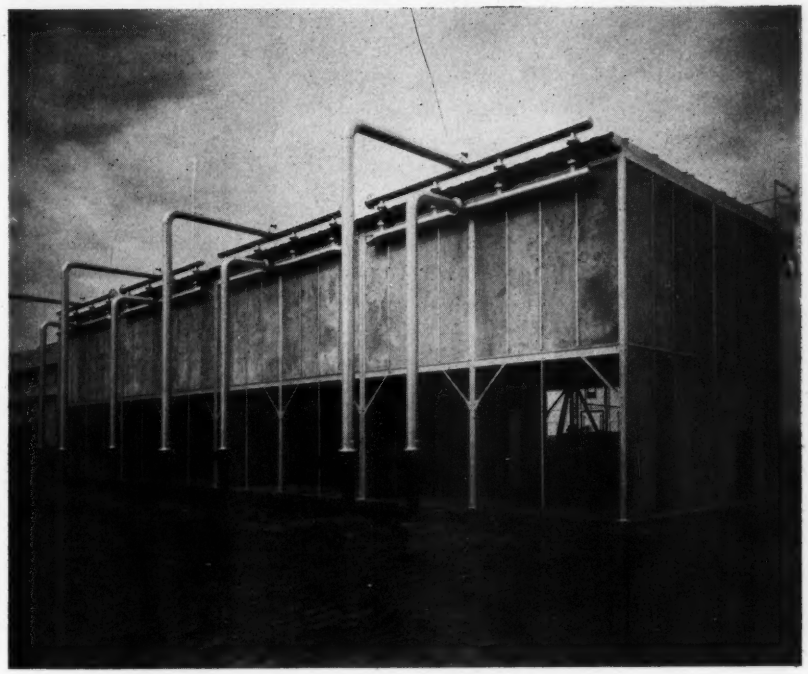
There are some fluids handled, however, which attack brasses and bronzes; for example, ammonia, coal-tar derivatives, and the amines, which require that steel or iron be used.

The desirable requirements for mechanical equipment today may be summarized as simplicity, durability, full-rated performance over extended periods, and minimum labor expense for operation, servicing and repairs. This is true whether it is installed in large plants, or in small plants in relatively isolated areas, thus directing attention to the use of air as a cooling medium.

Air As a Cooling Medium

As compared with water, air is even more abundant, and it is just as chemically stable. The impurities in air are seldom such as to foul, or corrode, equipment excepting where salt spray is encountered. It is disadvantageous in that its sensible heat capacity is but one-quarter that of water, but, in compensation, it can be brought to higher temperatures safely. Also, during the warm periods of the year, its temperature will exceed that to which water can be cooled in a cooling tower, which is to some extent offset by less variable performance due to absence of fouling. Lastly, due to the fact that its atmospheric specific volume is so many times greater than that of water—roughly 830 times—the horsepower required to move large quantities can easily be excessive, unless the pressure loss is kept to an absolute minimum—usually not over one-half inch of water.

Marked differences exist between the apparatus used with air as the cooling medium, and that with water. For the basic heat exchange sections, extended surface (finned) tubing has been found to be most economical, with the air passing across the exterior parallel to the fins which are mounted transversely to the longitudinal axis of the tubes. The fluids being cooled, or condensed, flow through the tubes which are joined together at both ends into flow-directing headers or manifolds. The characteristics of water cooled heat exchangers, both closed and open types, are well-known generally, and need not be described here. Water cooled apparatus for some services requires cleaning on both the insides and outsides of the tubes, while for air cooled equipment, cleaning is confined entirely to the insides of the tubes where it is more readily accomplished. It can also be appreciated that, as compared with closed water cooled apparatus, pressure type shell construction and large flanged joints are eliminated, because all that the air cooled sections need for directing the air flow are light gauge casings. Conversely, the heat transfer coefficients for the air cooled apparatus are considerably lower than for the water cooled units, requiring much more surface for the same duty. As this is expressed in terms of much less expensive surface, due to its finned nature, the disparity is to some extent offset. Negligible fouling factors for the air cooled equipment as compared with generous allowances for the other, also tend to balance the situation.



Air-cooled unit used at 8000 h.p. gas pipeline compressor station for engine jacket water cooling.

Air cooled units are complete in themselves and require no supplementary equipment. Air circulation is accomplished almost entirely by propeller-type fans, although in a few cases squirrel cage-type blowers have been used. These fans are simple, rugged devices, not requiring much attention or maintenance. Two illustrations depicting the structure and air-circulating mechanical assembly of a typical air cooled unit prior to installation of the heat transfer sections, are presented herein.

When considering the applications of air cooled aparatus up to the present, it must be remembered that operating practices generally have developed on the water cooled basis, and that the former has merely been substituted for the latter. A comparable example is the early automobile era which reflected wagon practice. The automobile, however, incorporates the most extensive application of air cooled apparatus which is the engine jacket water cooling radiator. It is also interesting to observe that the bulk of aeroplane engines today are directly air cooled, dispensing with an intermediate water jacket system. These are good examples of air cooled practice developing on its own, rather than as a substitute for water cooling, though they are exceptions.

Although the miscellaneous air cooled apparatus is not new, the greater proportion of the applications, up until about ten years ago,

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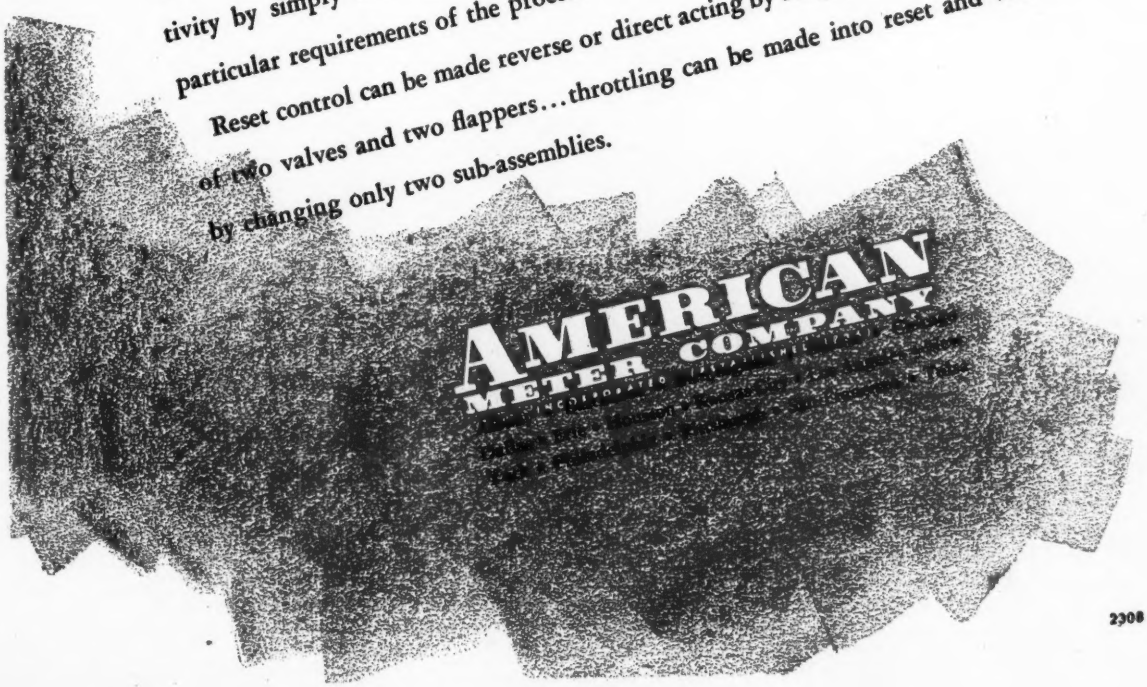

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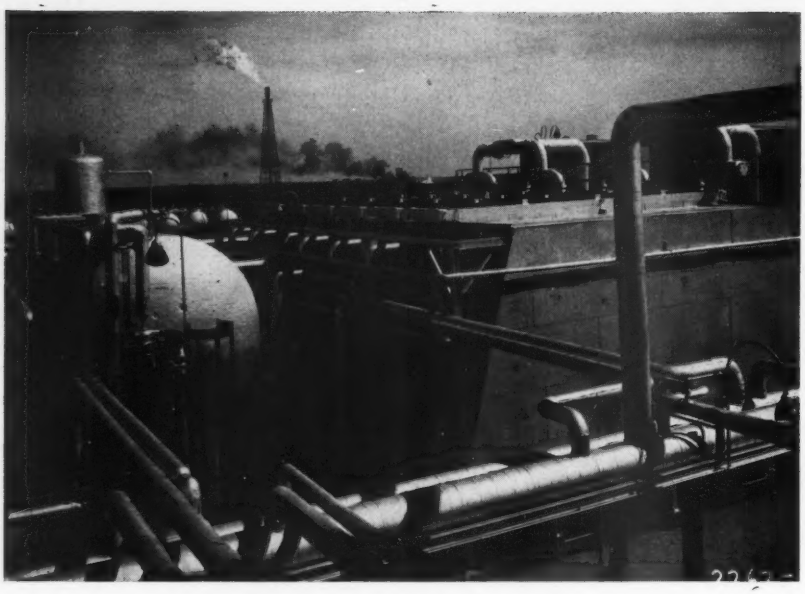

Large air-cooled exhaust steam condenser operations in a natural gasoline plant.

used natural draft. Some examples of these were finned type sections mounted crosswise to the prevailing wind for condensing exhaust steam, and the air cooled worms of early shell-still dephlegmators. Naturally, the performance varied with the wind, and could not always be relied upon. Since then, however, mechanical draft has been utilized to insure performance at all times. As a result, many successful installations have since been made, and both the numbers and types are continuously increasing.

Development & Economics of Air Cooling.

The need of such units, as might be expected, first became apparent in the southwest, in areas where water is scarce, and of very poor quality. Lubricating oil, jacket water, and gas coolers for gas engine driven compressor installations, exhaust steam and still condensers in field gasoline plants, and miscellaneous process units, all located in such areas, represented the first applications of large size air cooled apparatus employing forced air circulation. The operators of these plants began to show interest in such equipment in 1937. In some cases, lack of proper design data, or improper understanding of the principles of air circulation, resulted in operating difficulties, but by and large, all the installations were successful. As more and more of the operating advantages asserted themselves, other operators made such installations, and those who did so originally, purchased additional units. It was a great benefit to dispense with the need for a water supply system, and the treating and maintenance involved. The reduced labor requirements were also greatly appreciated, because such plants operate with a minimum force. Such installations are now fairly well standardized and made as a matter of course. Some figures dealing with representative installations are presented below.

The reader who cares to do so, can evaluate the figures against comparable water cooled installations.

As operating practice developed, more and more advantages of the air cooled units became apparent and were utilized. For exhaust steam condensers, steam turbine drives are now used, exhausting into the units themselves. Where units are installed to serve engines housed in buildings, it has been found that they can be located much closer to the buildings than cooling towers because free air circulation space is not required, and water spray and driftage are not problems. Air cooled units can very easily be roof mounted, avoiding the load and maintenance of a water basin. No precautions need be exercised during cold weather periods, and frequent painting of surrounding structures is unnecessary. Structural depreciation of the units themselves is neglible.

Other useful applications of this recent development, solving operating problems of long standing, have now been made. One interesting example is in the case of a gas processing plant, utilizing fluids which attack non-ferrous materials, and require steel piping, vessels, etc. The solution was an air cooled installation using heat exchanger sections having steel tubes fitted with the usual copper fins. These are entirely satisfactory in contact with the air. Several air cooled installations have been made wherein the high operating temperatures of the fluids to be cooled exceeded the desirable limits for water cooled apparatus. The air cooled units operated without difficulty. Still another case is the installation of an air cooled ammonia condenser together with a Diesel engine jacket water cooler.

JACKET WATER COOLERS FOR GAS ENGINE DRIVEN COMPRESSORS

Total Heat Dissipation BTU/Hour	Total Installed Cost	Total Fan Horsepower	Number and Size of Fans	Fan Drives	Ground Space Required
36,000,000	$50,500	169.6	4—16′ Dia.	4—50 H.P. Electric Motors	88 x25′
11,000,000	$25,700	41.6	4—10′ Dia.	4—15 H.P. Electric Motors	33′x27′
22,500,000	$47,265	75.6	6—10′ Dia.	6—15 H.P. Electric Motors	66′x27′

EXHAUST STEAM CONDENSERS

Total Heat Dissipation BTU/Hour	Total Installed Cost	Total Fan Horsepower	Number and Size of Fans	Fan Drives	Ground Space Required
55,000,000	$47,100	190.8	4—8.57′ plus 4—12′ Dia.	4—15 H.P. Electric Motors plus 4—35 H.P. Steam Turbines	42′x11′ plus 44′x31′
29,000,000	$20,600	50.0	2—12′ Dia.	2—43 H. P. Gas Engines	33′x20′

STILL OVERHEAD CONDENSERS

Total Heat Dissipation BTU/Hour	Total Installed Cost	Total Fan Horsepower	Number and Size of Fans	Fan Drives	Ground Space Required
3,500,000	$ 6,920	15	1—12′ Dia.	26 H.P. Gas Engine	15′x16′
5,500,000	$13,370	26.2	2—10′ Dia.	2—15 H.P. Electric Motors	17′x27′

PIPELINE COMPRESSOR STATION GAS COOLER

Total Heat Dissipation BTU/Hour	Total Installed Cost	Total Fan Horsepower	Number and Size of Fans	Fan Drives	Ground Space Required
6,030,000	$14,000	26.5	1—12′ Dia.	1—30 H.P. Electric Motors	17′x27′
*10,210,000	$19,000	40	1—14′ Dia.	1—40 H.P. Electric Motors	22′x27′

*—One Cooler per station for four stations, gas at 500 P.S.I.

This overcame the continual fouling of the equipment due to the cooling water picking up dust and fly ash from the atmosphere, and the appreciable bill for the city water used for makeup. Apropos of the latter point, there is an increasing tendency on the part of large municipalities to limit the use of system water for industrial purposes, due to water supply resources not keeping pace with their growth.

Operating practices for air cooled equipment are gradually being developed. As its use becomes more widespread, and better understood, the operating conditions selected will be more advantageous for its installation. This can best be illustrated by examination of the factors which influence its performance.

First and foremost, the ambient air temperature is of vital importance, because this directly affects the size of the equipment, and, in some cases, is critical as to whether or not the equipment can be used. Cooling water can usually be provided, if available, at a lower temperature during that part of the day when peak air temperatures occur. Accordingly, if the fluids are being cooled to temperatures closely approaching the cooling medium temperature, some adjustment may have to be made. For example, if a gas compressor aftercooler has been specified to cool the gas to 90 degrees F. or 95 degrees F., with cooling water available at 85 degrees, it will not be possible to do this on a straight air basis when air temperatures may reach 90 degrees to 100 degrees or even higher during summer days. Such low outlet temperatures may not be of great importance, and can be backed off as was done for some of the installations which have been made.

It is doubtful if air cooling will ever applied to the high vacuum condensers of turbo-generators, because considerable reduction in output would result from decreasing the vacuum in proportion to the elevation of the condensing temperature. It might be possible to develop the apparatus for full load at the times of the year when lower air temperatures prevail, and reduced load during the summer. Actually, air cooled condensers have been used with the portable power plants which were developed for use abroad in areas where the regular facilities had been destroyed during hostilities.

In each case an evaluation of the economics of temperature approach can be made, to determine desirable limits. This is of little importance for engine jacket water or lubricating oil coolers, as both services now operate with those fluids ranging from 140 degrees F. to 160 degrees F. It is likewise of little importance for exhaust steam condensers. In the case of still condensers, it may be necessary to reprocess the system for a higher operating pressure in order to obtain desired recovery at higher outlet temperatures. There is a definitely increasing tendency on the part of the process designers to raise outlet temperatures in order to insure stability of operations, and as this trend continues, air cooled apparatus will be more widely applied.

At this point it should be noted that some air cooled apparatus has been installed fitted with a water spray air cooling system to reduce the air temperature towards the wet bulb temperature before it enters the units. These show some saving in water consumption when used, if the range through which the air cooled is smaller than the range through which it is heated in the heat exchanger, and need not be used at all when air temperatures are moderate.

The factor of next importance is that of the air circulation itself. Careful studies must be made to balance the horsepower requirements for various air circulation rates against various static pressure losses to strike a balance between initial investment and operating cost. In general, the economies are in favor of low horsepower, larger first cost installations, but where power costs are low this is not necessarily true.

Another factor of importance is the type of fan drive selected. Most applications to date have used electric motors. Economies result from using two-speed motors which can be run at half speed during a substantial part of the year, reducing the power consumption upwards of 70 percent when so operated. Where close control of performance is desired, variable speed motors may be used, but these are not easy to accommodate for the usual alternating current systems.

Steam turbines are employed where steam is used in preference to electricity. These are very well suited for speed variation in order to control operations, and will undoubtedly find increasing usage for that purpose. In the gas fields, gas engine drive is by far the most economical, and speed regulation is quite simple.

The control of air cooled apparatus by varying the rate of air circulation is very effective. In addition to altering the mean temperature difference, there is normally a marked effect on the heat transfer coefficient as well.

It is hoped that a comprehensive picture of this growing method of cooling has been presented herein, and that those not familiar with such installations will be in a better position to visualize their possibilities. It is doubtful if the surface has been more than scratched, as yet, for applications of this type of equipment. The next ten years will undoubtedly witness development of its usage far beyond what this article reports.

"Petroleum Refining Processes," New 60-Page Brochure, Issued by Lummus

A new 60-page brochure, "Petroleum Refining Processes," R-9, containing the latest data on catalytic cracking, Polyform, lubricating oil, solvent refining and dewaxing, and petroleum chemical processes, has been issued by The Lummus Company, 420 Lexington Avenue, New York 17, N. Y.

Featuring 22 full-page flow charts of latest refinery processes, the book is a valuable aid to large and small refiners who must convert war facilities to peacetime manufacture. It is likewise of help to refiners who must build new equipment for the production of high octane motor gasolines.

Illustrated with numerous photographs of various types of process plants designed and built by Lummus, the brochure also gives specification and installation data on Lummus Oil Heaters and Lummus Heat Exchange Equipment.

PEACE ON EARTH

This Christmas we all rejoice in the end of the war.

To you, our many friends in the oil industry, the staff of this company wishes

A MERRY CHRISTMAS

AND

A PROSPEROUS NEW YEAR

H & B SALES COMPANY

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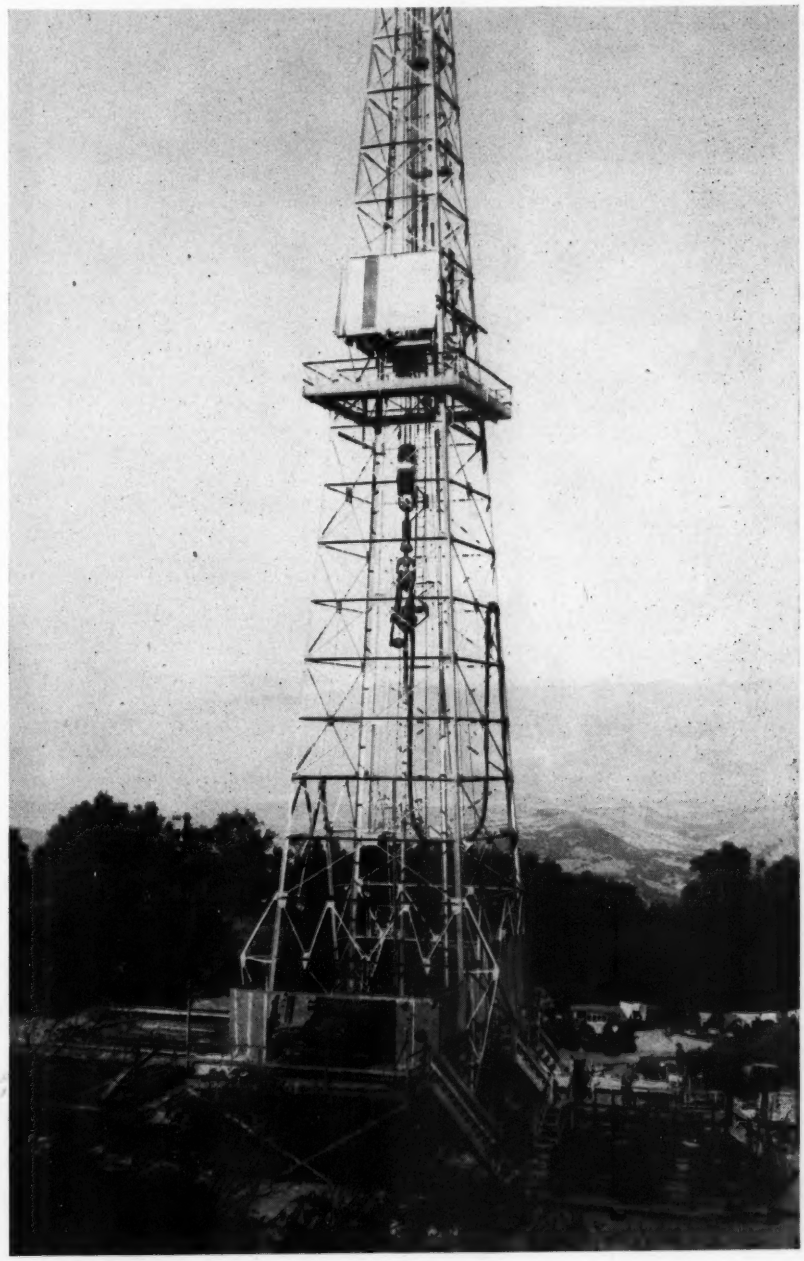
PACIFIC COAST DISTRIBUTORS FOR WILSON MFG. CO., INC.

Continental Wildcat Started on Red Mountain

Around Ventura many stories are told of how Joaquin Murietta, the early day California bandit, buried his loot on the tree covered slopes of Red Mountain and of the many unsuccessful searches for this hidden treasure. Oil operators have likewise pitted their ingenuity against the mystery of possible treasure in the form of petroleum under the depths of the mountain. They have been intrigued by the Red Mountain anticline, but the extremely hard formations and great depths required, frustrated the early attempts of drillers to successfully test the structure.

As far back as September 10, 1912, a cable tool well was spudded by California Counties Oil Company on the northwest side of Red Mountain. This well was finally abandoned November 12, 1914, when a depth of 1985 feet was reached. In 1921 Shell Oil Company took a fling at the Mountain and drilled a well known as Hobson No. 1 to 3277 feet before losing hope. Then along came E. J. Miley, who drilled his Casitas No. 1 to 1911 feet in 1925 and Casitas No. 2A to 1388 feet in 1928. As a result of bad luck and records of hard formations encountered, the deer and stock had free run of the mountain until October 29, 1936, when Continental Oil Company spudded its Casitas No. 1 on the north flank of the mountain, using a modern rotary rig. The original road that had been used by Miley was repaired and used for access to the Continental well. On July 8, 1937, over eight months later, Continental started abandonment of the well, having reached a depth of 8018 feet. Five 4-way and fishtail bits, eighty-eight rock core heads and one hundred and thirty-two rock bits were used to reach this depth. The last twenty-three runs into the hole developed an average of 6.2 feet per bit, with actual drilling speeds in the neighborhood of one foot per hour.

After a lapse of about eight years, during which Continental was busy developing its San Miguelito Field between Red Mountain and the ocean, it became apparent that Continental's geologists and engineers were still active as derrick builders again appeared on the crest of Red Mountain. The well, known as Casitas No. 2, is located on the Walter and Edith Hoffman Rancho Casitas. A visitor to the well drives up Casitas Pass Road along Coyote Creek and in roadside alfalfa pastures may see future contenders for honors on polo fields or the tracks at Santa Anita or Hollywood Park. Located about one-half mile south of Casitas No. 1, the well was spudded on November 7, 1945, and the battle for oil under Red Mountain is again under way. At 75 feet they lost circulation which required eight cement jobs, and between 450 and 950 feet they had two twist-offs, one lost circulation job, and landing of 13⅜"



Rig—Conoco Casitas No. 2. Mountains near Ojai in background.

Looking past water tank—over Ventura and ocean.

surface pipe at 538 feet. At latest reports they are drilling below 1700 feet. From the derrick floor, located on the ridge of the mountain at an elevation of 1988 feet, the view includes the cities of Ojai and Ventura with the mountains behind them as well as the ocean and Continental's San Miguelito Field. A 136 foot derrick is being used with a conventional steam rotary which has drilled 13,000 foot wells in San Joaquin Valley.

Remains of E. J. Miley's Casitas No. 2-A

The geologists expect the well to drill through the red Sespe surface rocks and enter Eocene formations before crossing the Red Mountain fault and entering the younger Pliocene formations. In view of the necessity for new oil fields in California, it is hoped that Continental will be successful in this, its latest venture.

Col. Verne Austin Presented Merit Award

Lieutenant Colonel Verne Austin, who before joining the U. S. Cavalry in February, 1941, was petroleum engineer with the State Division of Oil and Gas, was recently awarded a citation for the Legion of Merit.

The decoration was presented by Major General William E. Shedd, commanding general of the Ninth Service Command at Papago Park, prisoner of war camp, Phoenix, Arizona, which Colonel Austin now commands.

The citation lauds his "firmness and tact" and was recognition of Colonel Austin's leadership in restoring law and order at Camp Tule Lake, California, when domestic and international problems there called for courage and diplomacy. He took over the Tule Lake camp in September, 1943, and was sent to the Papago camp in February of last year, after several German prisoners of war escaped.

Before taking command at Tule Lake, he was in charge of plant protection of all petroleum facilities in the nine western states.

Scully Returns to Private Practice

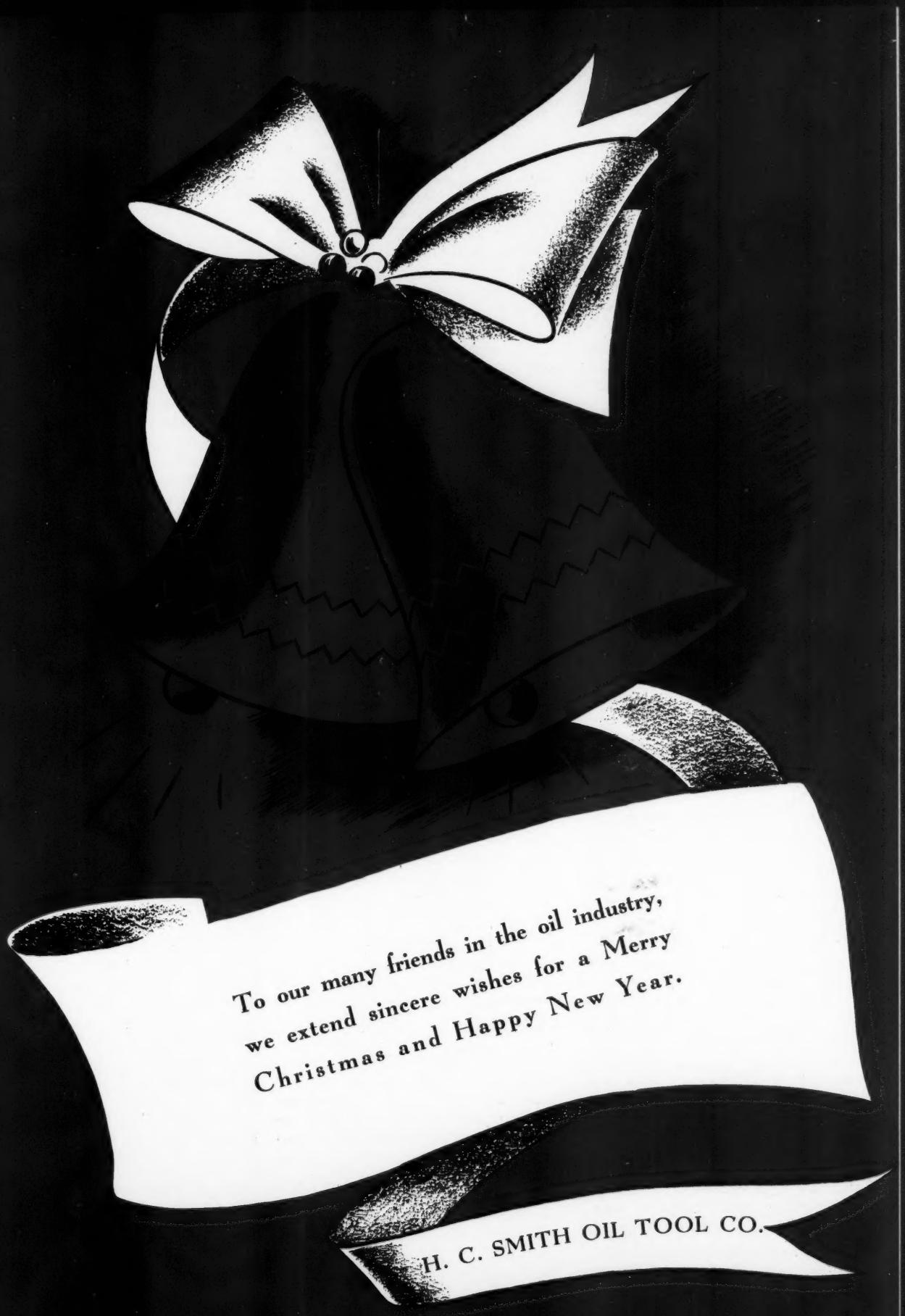
Colonel William S. Scully, who for many years has been prominent in professional circles and well known in the oil industry here, has returned from active duty with the Army under his reserve commission, to become associated with the law firm of Hill, Morgan & Farrer, with offices in the Title Guarantee Building.

Col. Wm. S. Scully

Prior to entering upon active duty with the Army in the Judge Advocate General's Department, he occupied the position of General Counsel for Independent Refiners' Association of California of Los Angeles. Immediately after his return in April from approximately three years duty overseas and subsequent relief from active duty, he was appointed Assistant Chief Counsel, Petroleum Administration for War, Washington, D. C., serving in that capacity until the latter part of October of this year.

In addition to the general practice, he will devote special attention to matters connected with the oil industry.

BUY VICTORY BONDS


To our many friends in the oil industry,
we extend sincere wishes for a Merry
Christmas and Happy New Year.
H. C. SMITH OIL TOOL CO.

Hydrocarbon Thermodynamics

PART II.

(Continued from 2nd November Issue)

By
WAYNE C. EDMISTER
Foster Wheeler Corporation
New York, N. Y.

PHASE EQUILIBRIA

The equilibrium relationship between vapor and liquid is of major importance in practically all hydrocarbon processing operations. As outlined above in the discussion of vapor pressures and phase diagrams, phase equilibria conditions for hydrocarbon mixtures may be estimated by component or empirical methods. Empirical methods are used only on higher boiling hydrocarbon mixtures, such as petroleum fractions, that are normally defined by laboratory distillation curves. The component method is always used for lighter hydrocarbon mixtures and may be used also for the higher boiling hydrocarbons, particularly in the gasoline and naphtha range.

Such fractions are usually broken down into "hypothetical" components from distillation curves to permit making the component phase equilibria calculations. In the gasoline range the presence of lighter hydrocarbons usually makes it impractical to apply the empirical method so the component method is used.

The fundamentals of component phase equilibria are shown in Table IV. From this concise presentation of the subject it can be seen that there are three different types of phase equilibria relationships, namely;

(1) the vapor pressure relationship where vapor pressures and total pressures are used, which can be done at low pressures, and/or high temperatures.

(2) the ideal solution fugacity relationship, where fugacities from Figure 9 may be used; and,

(3) non-ideal solutions, for which fugacities corrected for the deviations from ideal solutions must be used for either or both phases.

Most phases equilibria conditions encountered in hydrocarbon processing fall under the second classification and for these calculations the equilibrium constants computed from Figure 9 are adequate. In this connection it is of interest to refer to Figure 1, which shows a comparison of fugacities of liquid and vapor with the vapor pressures and total pressures. From this nomegraph, one can see at a glance where fugacities differ appreciably from vapor pressures and total pressure. This chart is presented for reference only and is not intended for use in making calculations. From Figure 1 it can be seen that the vapor fugacities of methane are not far from the total pressure, while the liquid fugacities of methane are appreciably lower than the vapor pressures.

In computing fugacity phase equilibrium constants from Figure 9, it is necessary to extrapolate the vapor pressures of the lower boiling hydrocarbons above their critical point. This is done on semi-log paper plotting log of the reduced pressure against reciprocal of the reduced temperature. Calculations of this type have been made by many in the past and the results plotted to give the well known "K" charts. Figure 13 is a plot of this type for several light hydrocarbons at 300°F. It will be noted that the curves all converge at a value of $K = 1.0$ and a pressure of 900 p.s.i.a.

At the critical point of a mixture there can be no separation into vapor and liquid phases, the mixture being of a homogenous continuous phase between liquid and vapor. At this point the equilibrium constants for all the components present must be equal to unity to satisfy this condition. Under other conditions of temperatures and pressure, the "K" constant curves approach unity also, but at a higher value of pressure. The pressure at which the K constants become unity is called the "convergence pressure." This intersection at unity may be real or imaginary, real when the system temperature is the critical temperature of the mixture, and imaginary otherwise.

The "K" curves become discontinuous at the border curve when extrapolated toward a fictitious convergence pressure at temperatures below the critical temperature of the system.

It will be noted on Fig. 13 that the fugacity K constant curves show that this tendency to converge exists for ideal solutions (see dashed lines.) For non ideal solutions, this trend toward convergence of K constant curves takes place at lower pressures. This is one characteristic of non ideal solutions.

When the temperature of the system is the same as the critical temperature of the mixture, the convergence pressure is the critical pressure of the mixture and the K constant lines converge to unity on this plot. When the temperature of the system is below the critical temperature of the system, the convergence pressure is an imaginary pressure, at which the K constant curves would converge if extrapolated, and is used as a tool to correct for deviations from ideal solutions. With a method for predicting the convergence pressure, the minimum value of "K" for each component and the pressure at the minimum K, values of K may be corrected for deviation from ideal solutions at high pressures by plotting as on Fig. 13.

The prediction of the convergence pressure is the most difficult part of this problem. Experimental phase equilibria data available indicates that the convergence pressure may be estimated as the critical pressure of an imaginary mixture of the lightest and heaviest components, the proportions being such that the binary has a critical temperature equal to the temperature of the system. From critical data appearing in the literature for binary mixtures, a plot has been constructed to give the approximate value of the convergence pressure or the critical pressure of binary mixtures. This chart is giv-

en as Fig. 14, which is presented for reference only, this correlation not being accurate enough for very precise calculations. Approximate as this plot is, it indicates the effect of the variables on the convergence pressure. In a similar manner Figs. 15 and 16 were prepared from information available in the literature by reconstructed correlations given in the indicated reference. These correlations give the minimum value of K and the pressure at this minimum value as a function of the convergence pressure for the mixture and the vapor pressure of the component in question. By means of the correlation presented in Figs. 14, 15 and 16, it is possible to estimate values of K where laws of ideal solution do not apply. The use of these three charts (Figs. 14, 15 and 16) to construct a plot similar to Fig. 13 requires no explanation.

Another method of estimating phase equilibria constants in the non ideal solution range is the computation of the fugacities of both liquid and vapor phases by means of a precise equation of state that applies to the mixture in question. These liquid and vapor fugacity equations are functions of the compositions of the phase in question, as well as the temperature and pressure and therefore very complex equations to formulate. In addition the results are difficult to apply because many successive approximations are required in order to determine the phase composition, which is required in estimating the fugacity.

PHASE EQUILIBRIUM

VAPOR PRESSURE RELATIONSHIP

Combining Dalton's Law, $p = Py$ and Raoult's Law, $p = \pi x$ Gives

$$p = \pi x = Py$$

Valid only at Low Pressures for Ideal Solutions

$$K = \frac{y}{x} = \frac{\pi}{P}$$

K = Equil. Phase Distribution Const.

x, y = Mol Fract. in Liq. & Vap.

p, π, P = Partial, Vapor and Total Pressures

FUGACITY - ESCAPING TENDENCY

For Perfect Gas

$$\Delta F_T = RT \operatorname{Ln} P_2/P_1$$

For Actual Gas

$$\Delta F_T = RT \operatorname{Ln} f_2/f_1$$

Where f is the Fugacity, which is Defined to Replace Pressure, From which

$$RT \operatorname{Ln} \frac{f}{p} = -\int_0^P \alpha \, dP$$

Where $\alpha = V - \frac{RT}{P}$

FUGACITY EQUILIBRIUM RELATIONSHIPS

Ideal Solutions - Fugacity of each component is proportional to its mol fraction at every temperature & pressure

$$f_L x = f_v y$$

$$K = \frac{y}{x} = \frac{f_L}{f_v} = \left(\frac{f_L/\pi}{f_v/p}\right)\frac{\pi}{P}$$

$f_L = f_\pi$ = Fugacity of pure component in liquid phase or at the vapor pressure, π.

$f_v = f_p$ = Fugacity of pure component in vapor phase or at the total pressure, P.

Non-Ideal Solutions - Fugacities of components in both liquid and vapor phases are functions of temp., press., and phase compositions

1. Phase Diagram Method
2. Equil. Bomb Method
3. Convergence Pressure
4. Equation of State Method

Table IV
Phase Equilibrium (Reference 7. See also Reference 2)

ENTHALPY-ENTROPY CHARTS

It is necessary to know differences in the enthalpy (heat content) in making heat balance calculations for hydrocarbon operations, which may take place at constant pressure, temperature, or entropy. In the latter case the quantitative value of the entropy is not required, it being sufficient to know that the entropy remained constant. Differences in entropy are rarely required. Enthalpies and entropies may be tabulated as in the steam tables or presented graphically in the form of Mollier diagrams. There are two types of Mollier diagrams in use, the most well known probably being the type using entropy and enthalpy as the coordinates with lines of constant temperature and pressure in the vapor region, and the other being the type using enthalpy and pressure (the latter on logarithm scale) as the coordinates with lines of constant temperature and entropy in the vapor region. Diagrams of this type may be prepared for pure components and for mixtures as well. The preparation and application of such diagrams for hydrocarbon systems will be discussed, with a few sample charts as illustrations.

The Mollier Diagrams for steam and ammonia have long been a very useful tool of the engineer. Many years of work have gone into the development of these diagrams. Hydrocarbon systems are much more complex because of large number of components and the unlimited

CHEMICAL REACTION EQUILIBRIUM

HEAT OF REACTION

$$\left(\frac{\partial \Delta H}{\partial T}\right)_p = \Delta C_p$$ From which

$$\Delta H_2 - \Delta H_1 = \int_1^2 \Delta C_p \, dT$$

$C_p = A + BT + \frac{1}{2}CT^2$; for each component. Adding constants A, B, C algebraically gives $\Delta C_p = \Delta A + \Delta BT + \Delta CT^2$ for mixtures

Substituting and integrating

$$\Delta H = \Delta H_0 + \Delta AT + \tfrac{1}{2}\Delta BT^2 + \tfrac{1}{3}\Delta CT^3$$

FREE ENERGY OF REACTION

$$\frac{d\left(\frac{\Delta F}{T}\right)}{dT} = -\frac{\Delta H}{T^2}$$

$$\Delta F = \Delta H_0 - \Delta AT \operatorname{Ln} T - \tfrac{1}{2}\Delta BT^2 - \tfrac{1}{6}\Delta CT^3 + IT$$

Integration constant I evaluated from ΔF at known temperature and ΔS from Third Law and following equation

$$\Delta F = \Delta H - T\Delta S$$

EQUILIBRIUM YIELDS

Equilibrium Constant from ΔF

$$\Delta F = -RT \operatorname{Ln} K_f$$

Law of Mass Action

$$aA + bB = cC + dD$$

$$K_p = \frac{(\text{Conc } C)^c \, (\text{Conc } D)^d}{(\text{Conc } A)^a \, (\text{Conc } B)^b}$$

For vapor phase reactions partial pressures and activity coefficients may be used as follows

$$K_p = \frac{K_f}{K_\gamma} = \frac{(P_C)^c \, (P_D)^d}{(P_A)^a \, (P_B)^b}$$

$$K_\gamma = \frac{(\gamma_C)^c \, (\gamma_D)^d}{(\gamma_A)^a \, (\gamma_B)^b}$$

DATA REQUIRED

1. Heat capacities
2. Heats of Formation
3. Absolute Entropies
4. Vapor Pressures and Fugacities

Table V
Chemical Reaction Equilibrium (Reference 7)

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AQUAGEL, and other Baroid Products, are quickly available in nearly 450 locations in the United States and Canada.

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TESTING EQUIPMENT
BAROID WELL LOGGING SERVICE

number of mixture compositions.

By the methods described below, enthalpy-entropy diagrams may be prepared for single or multi-component hydrocarbon systems.

Entropies and enthalpies are computed for pure hydrocarbons by applying the equations given in Table III and the correlations given in Figures 1, 7, 8, 10 and 11. Entropy vs temperature and enthalpy vs temperature plots are constructed from the results of these calculations. This is done by selecting a datum point, which may be liquid at any desired temperature or it may be vapor at specified temperature and pressure conditions, and then building the chart up from this point with latent heats, effects of pressure and temperature being involved in the construction. Enthalpy plots for three light paraffin hydrocarbons (methane, ethane and propane) are shown on Figure 17. These plots are for reference only. Similar plots can be made for the entropy in like manner. The entropy and enthalpy plots can then be combined to form a Mollier Diagram. Such diagrams are shown on Figures 18 and 19 for propane and butane. The datum or reference state for the enthalpy diagrams in Figure 17 is liquid at 32°F., while the datum for the Mollier diagrams in Figures 18 and 19 is liquid at -200° F. These datum points are arbitrary, 32°F. being selected for the enthalpy plots to make them consistent with other charts and -200° F. being selected for the Mollier diagrams in order to avoid having any negative values of enthalpy when applying the charts to refrigeration calculations.

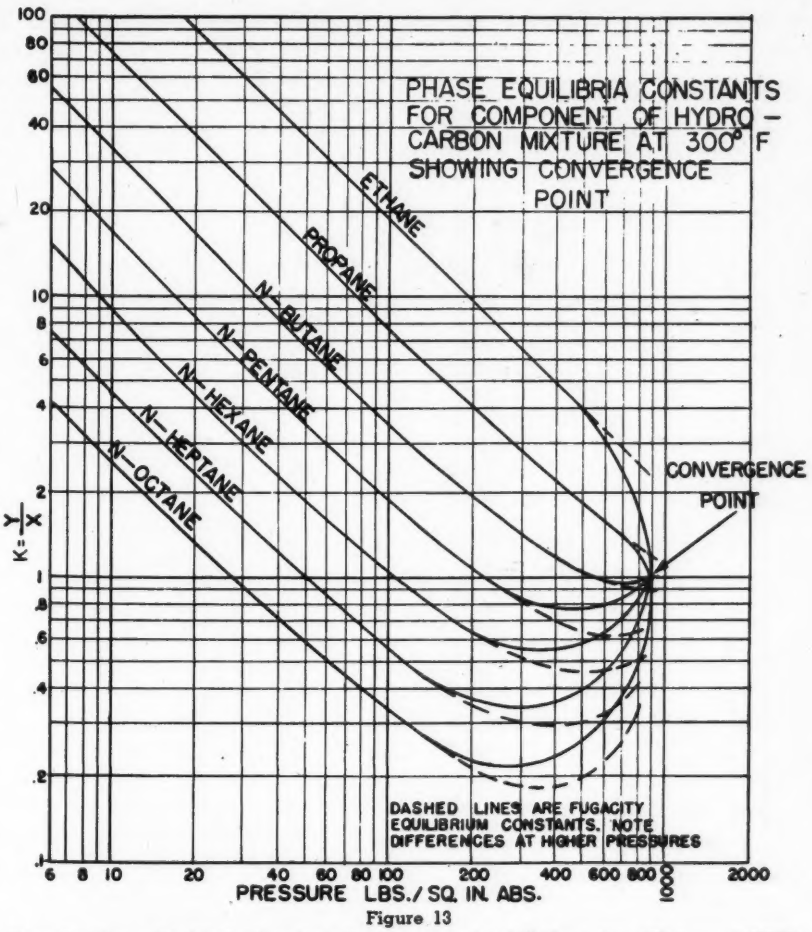

Figure 13

Fugacity Phase Equilibria Constants for Components of Hydrocarbon Mixture at 300°F., Showing Convergence Point (References 14, 34).

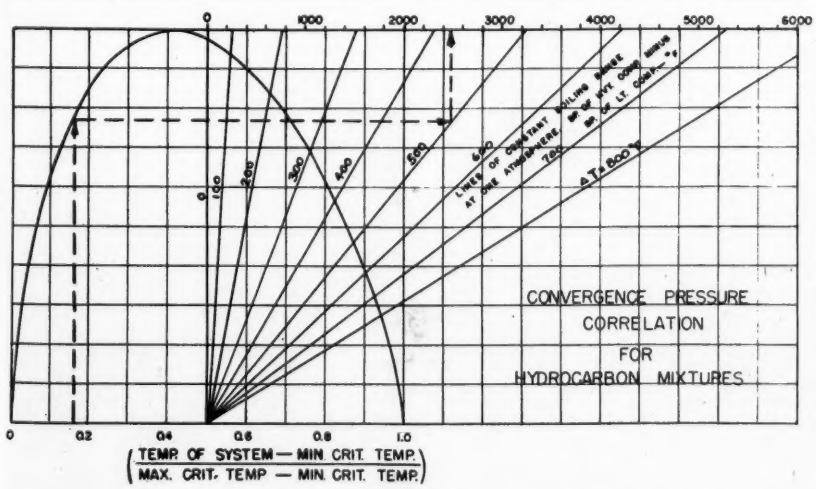

Figure 14

Convergence Pressure Correlation for Hydrocarbon Mixtures (References 16, 19, 27, 28, 30, 34).

It will be noted that "extrapolated" vapor pressure lines are drawn on the enthalpy diagrams in Figure 17. These lines give the enthalpies for hypothetical liquid conditions that exist when the component in question is a lighter component of a liquid hydrocarbon mixture. These extrapolated vapor pressure curves are obtained from a Cox type vapor pressure plot by extrapolating above the critical point. Enthalpy plots like those in Figure 17 may be applied to hydrocarbon mixtures by the procedure outlined below.

The temperature, pressure, and phase conditions encountered in most heat balances involving light hydrocarbons are such that either one or both of the following phenomena exists: (a) A liquid hydro-

PETRECO

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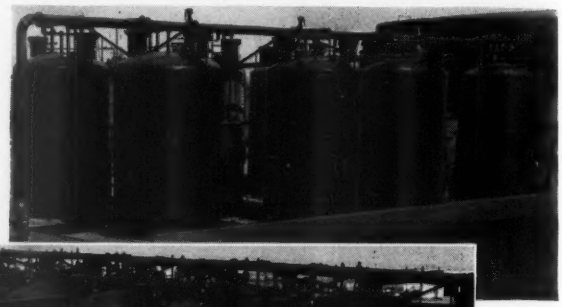
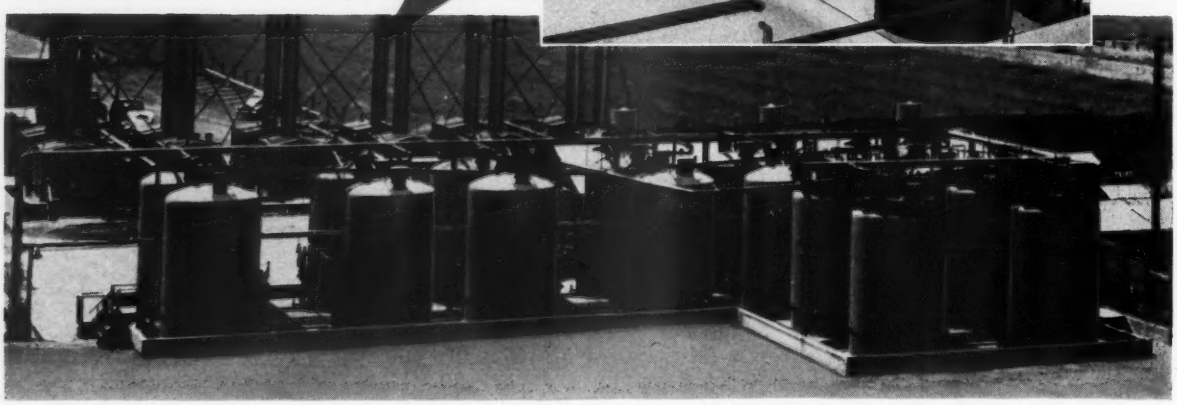
THEN 12 UNITS FOR 15,000 BARRELS

NOW 16 UNITS FOR 20,000 BARRELS





Growing demands for production by important oil producers can be met only by progressive additions to plant and equipment . . . At the Union Oil Company's Battles Station Plant, in the Santa Maria Valley field of California, this is demonstrated by the manner in which additions to the Petreco Dehydration plant have kept pace with increased crude oil production. First installation of eight Petreco Dehydration units began operation in June, 1942, when the plant had a designed capacity of 10,000 bbls. per day. In October of the same year capacity was stepped up to 15,000 bbls. daily and four more dehydrators were added. In June, 1944, capacity was again raised to a new high and four units were installed to insure 20,000 barrels of clean oil daily . . .

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Dehydrating • *Electrical Processes* • Desalting

carbon mixture at a temperature higher than the critical temperature of some of the lighter components therein; and (b) A vapor hydrocarbon mixture under a pressure higher than the vapor pressure of some of the heavier components therein. The conditions at which the enthalpies for the components of hydrocarbon mixtures should be read from the pure hydrocarbon charts are established by the following assumptions, which appear to be justified by accurate heat balances on plant equipment.

Liquid Mixtures. (a) enthalpies for components whose critical temperatures are above the temperature of the mixture are read from the saturated liquid curves of the pure hydrocarbons at the temperature of the mixture; (b) components whose critical temperatures are below the temperature of the mixture are assumed to be at a hypothetical liquid state, enthalpies being read from the extrapolated vapor pressure line of the pure hydrocarbons at the temperature of the mixture.

Vapor Mixtures. (a) enthalpies for components whose vapor pressures are higher than the pressure on the system are read from the pure hydrocarbon plots at the temperature and pressure (total, not partial) on the system; (b) components whose vapor pressures are lower than the pressure on the system are assumed to be hypothetical vapor and their enthalpies are read from the saturated vapor curve of the pure hydrocarbons at the temperature of the mixture.

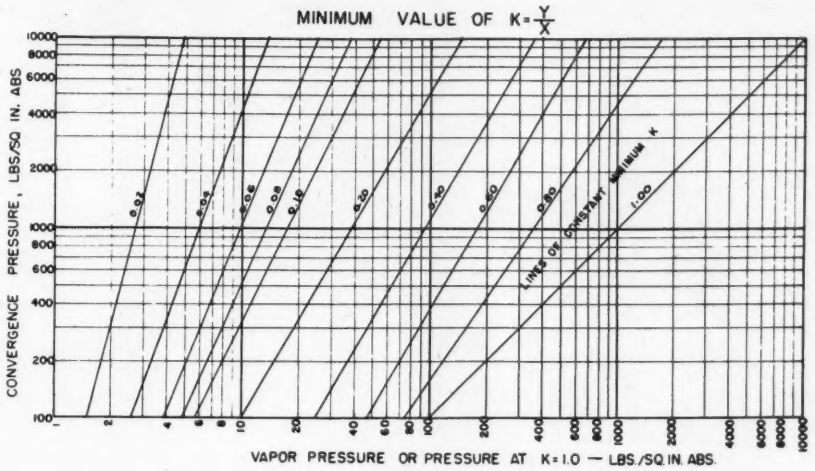
MINIMUM VALUE OF K = Y/X
CONVERGENCE PRESSURE, LBS/SQ IN. ABS
VAPOR PRESSURE OR PRESSURE AT K=1.0 — LBS./SQ.IN. ABS.
LINES OF CONSTANT MINIMUM K

Figure 15
Minimum Value of K near the Convergence Point (Reference 34).

Additivity. The enthalpies of the components of a hydrocarbon mixture are assumed to be additive.

In applying this method to the computation of enthalpies for mixtures, it is necessary to know the phase conditions which may be estimated by the phase equilibria methods outlined above. Following this procedure for entropies and enthalpies, the Mollier diagram shown in Figure 20 was prepared for a propane-butane mixture. This and similar charts are useful in making refrigeration calculations.

The above method of computing entrophies and enthalpies for hydrocarbon mixtures is one of three methods that may be used, the other two methods being: (1) the pseudo critical method, and (2) the equation of state method. The pseudo critical method is readily applied by means of the correlations and equations presented above. In this method the pseudo critical for the mixture is used in estimating the isothermal effect of pressure on the entropy and enthalpy of the mixture. The latent heat of vaporization is computed by the entropy function method described above. Phase conditions are likewise required for this mixture in this method.

The equation of state method is analogous to the equation of state method mentioned above for estimating phase equilibria conditions for non ideal solutions. This method is complex and of little practical value except to spot check enthalpies and entropies computed by the other methods. In preparing the Mollier Diagram for propane-butane (Figure 20) and other similar diagrams, the pseudo critical and the equation of state method were used to check several points. Agreement was satisfactory.

Figure 21 is an enthalpy diagram for gasoline prepared by the pseudo critical method, empirical methods being used to estimate the phase equilibria conditions. Similar diagrams may be prepared for any hydrocarbon mixture or petroleum fraction by the same method. The preparation of such charts is desir-

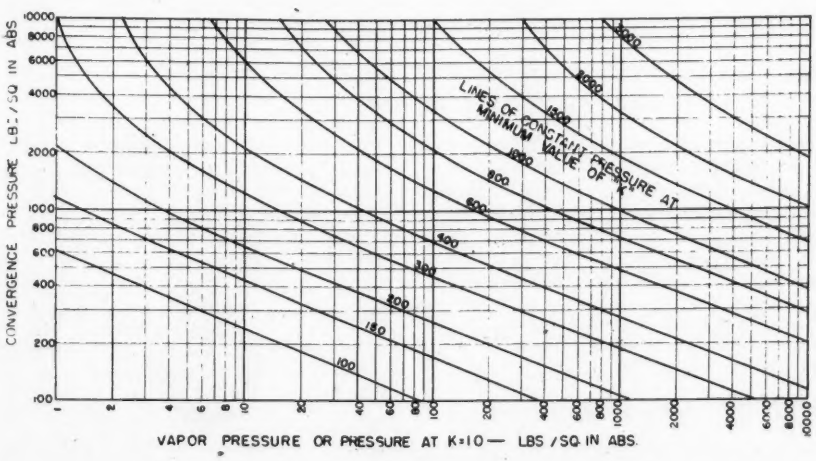
CONVERGENCE PRESSURE LBS/SQ IN ABS
VAPOR PRESSURE OR PRESSURE AT K=1.0 — LBS/SQ IN ABS
LINES OF CONSTANT PRESSURE AT MINIMUM VALUE OF K

Figure 16
Pressure at Minimum K near the Convergence Point (Reference 34).

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able when many calculations must be made for the same stock.

The component enthalpy diagrams may be applied to make net heat balances or total heat balances. In making net heat balances, i.e. net enthalpy change for each component in going through the system, the datum point is not important. With total heat balances, the datum point for all components should be the same.

HYDROCARBON REACTIONS AND COMBUSTION

Thermodynamics is a useful tool in studying hydrocarbon reactions. It may be used to estimate the driving force and equilibrium of a given reaction, and thus predict whether or not a given reaction will occur and the conditions that are most favorable to it. By a combination of thermodynamics and kinetics, the equilibrium distribution of products may be estimated. Thermodynamics may also be used to compute the heat absorbed or liberated for reactions. Table V presents the fundamentals of applying thermodynamics to chemical reactions.

The heat of reaction is the quantity of heat that must be added or removed to make the reaction take place. This heat is not recoverable. When heat must be added the reaction is "endothermic" and when heat is removed the reaction is "exothermic". Cracking is "endothermic" and polymerization is "exothermic". By the combination of thermochemical equations, heats of reactions for hydrocarbons may be calculated from the heats of formation of the reactants from carbon and hydrogen. Heats of formation can be evaluated by a similar combination of heats of combustion. Heats of reaction may also be determined experimentally in a calorimeter.

Because of the many side reactions that usually occur in hydrocarbon reactions, it is difficult to correlate experimental heats of reaction unless the theoretical method, based on heats of combustion, is also employed. The heat of reaction for hydrocarbon reactions depends upon the type and quantity of hydrocarbon molecules made in the reaction. From a study of theoretical heats of reactions and the compositions of products from various reactions, the diagram shown as Figure 22 was constructed to show the relative effects of the various factors on the heat of reaction. This plot is for reference only and not intended to be of sufficient accuracy for design calculations.

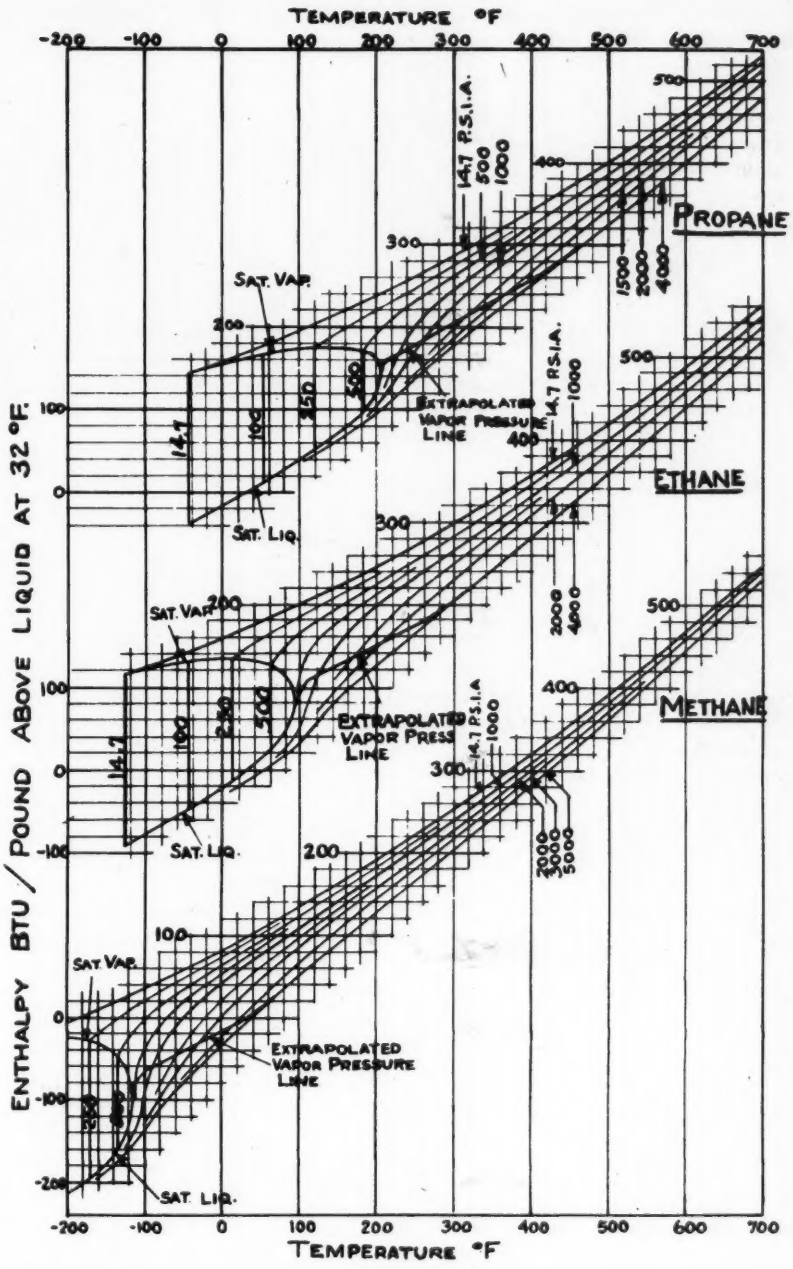

Figure 17
Hydrocarbon Enthalpy Plots (Reference 6. See References 20, 22).

In making a heat balance on a hydrocarbon reactor, it is important to be consistent in the enthalpies of reactants and products and the heat of reaction used. A recommended method is to make a net heat balance, i.e. compute the amount of heat required to heat the feed up to the reaction conditions, compute the heat of reaction at reaction condition, and compute the change in enthalpy of the products from reaction temperature to exit temperature. The algebraic sum of the heat quantities gives the heat

balance. This method avoids computing the heat quantities of all hydrocarbons involved above an arbitrary and meaningless datum point and therefore avoids possible errors. In making these computations care should be taken to have the heat of reaction corrected to the reaction temperature. This point is emphasized because heats of reaction are often given at "standard states".

Enthalpies of flue gases are used in making furnace and catalyst regeneration calculations. Flue gas enthalpies depend upon the composition of the fuel and the amount of excess air used. For hydrocarbon fuels, such as gas and oil, the flue gas enthalpies can be plotted as a function of hydrogen/carbon ratio and percent excess air. Such a plot is presented as Figure 23. The use of this graph is obvious.

PROCESS APPLICATIONS

As an example of the applications of thermodynamics to hydrocarbon process design, a fluid catalytic cracking unit with fractionation and vapor recovery facilities may be considered. In this process, oil is cracked in the presence of a fluidized catalyst, which circulates through the reactor and regenerator system picking up heat in the regenerator, where the coke is burned off by air, and liberating this heat in the reactor by transfer to the oil. The cracked products are fractionated, the light ends and gasoline going to a vapor recovery unit, via compressors and pumps, to be separated into desired products.

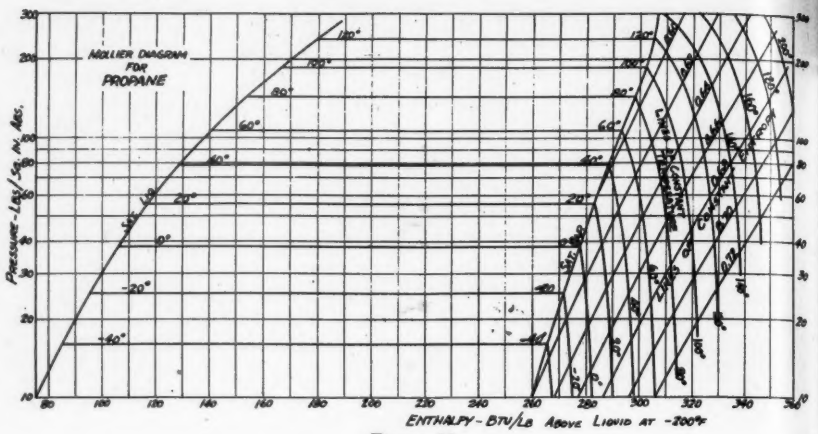

Figure 18
Mollier Diagram for Propane (Reference 20).

Thermodynamics is involved at the following points: (1) turbo air blower design, (2) regenerator heat balance, (3) reactor heat balance, (4) fractionator phase equilibria and heat balance calculations, (5) product gas compressor design, (6) phase equilibria and heat balance calculations in the design of the vapor recovery facilities, and (7) making steam and condensate balances for the waste heat boilers, which generate steam while controlling the temperatures at important points in the system, and the steam users, i.e., turbo air blower, pumps, etc.

In designing other types of petroeum refining equipment, similar applications of thermodynamics are included in the process calculations.

Some catalytic processes are batch operations with intermittent reaction and regeneration, reaction being at an appreciably lower pressure than regeneration. In such processes it is frequently desirable to provide facilities for transferring heat liberated in the regenerator to the reactor, in order to maintain an even temperature. In the Houdry catalytic cracking process this is done by a molten salt heat carrier. This transfer of heat from the exothermic regenerator to the endothermic reactor does not dispose of all of the available heat energy however. The flue gases may, and usually are, sent through a waste heat boiler, generating steam, and/or through a flue gas turbine, generating power.

Another application of thermodynamics to petroleum refining process design worth noting is the use of the phase diagram in calculating pressure drops and in estimating the proximity to coking in an oil heating furnace.

Experience has shown that coking is more likely to occur in an oil heater when there is a small amount of liquid, or when the oil is almost completely vaporized. These calculations become somewhat involved for a cracking furnace where the composition is changing. Calcula-

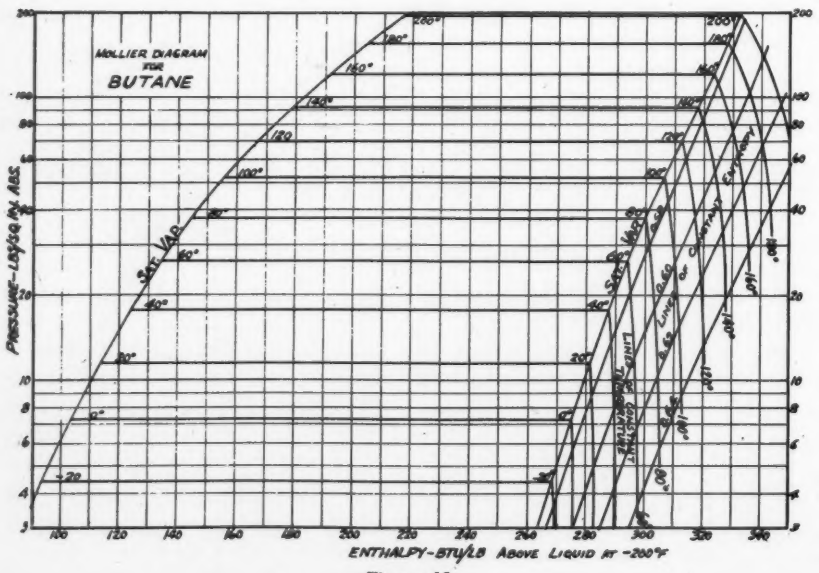

Figure 19
Mollier Diagram for Butane (Reference 20).

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You can safely fish for unknown O.D.s with the SHAFFER LONG PULL-DOWN SOCKET!

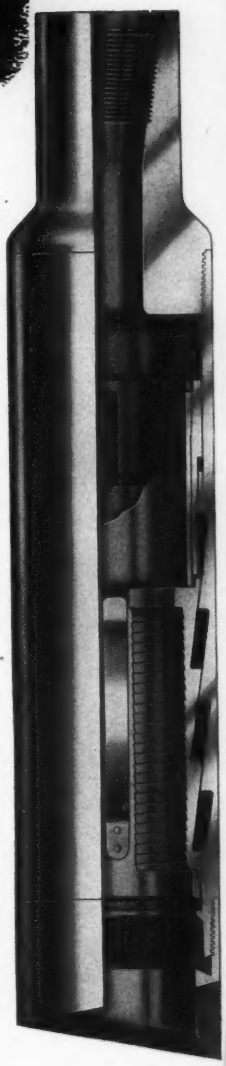
YOU CAN guess—but you seldom *know*—the exact outside diameter of subs, tool joints, upsets and drill collars in the hole, because the abrasive wear of drilling reduces these diameters to unknown factors. And when a fishing job occurs, you're taking big risks trying to catch worn o.d.'s *unless you use the fishing tool that compensates for wear . . . the Shaffer Long Pull-Down Releasing Socket!*

This Shaffer tool is especially engineered to cut the risk of fishing for unknown diameters. It is made with steep slip tapers and extra-long slip contraction. Thus it *automatically* compensates for wear on subs, tool joints, etc., and insures a full, safe grip. You can use it to catch undersize o.d.'s that are considerably smaller than maximum for the particular size Socket being run, completely avoiding the dangers of fishing with undersize slips.

And here's another important point:

The releasing cam is placed *above* the slips instead of below them as on conventional types, and a packer is installed just under the slips as shown in the cut-away view. Thus, for even a short-length hold on a tool joint, for example, the joint can be gripped *and packed off*, whether it is worn or not!

The Shaffer Long Pull-Down Releasing Socket employs the same patented releasing principle as other Shaffer Sockets, and is operated in the same manner. But it has the extra margin of protection afforded by its long pull-down feature for worn or unknown o.d.'s. It is made in all popular sizes, and is *another* Shaffer fishing tool available 24 hours a day—every day in the year—from Shaffer's conveniently located plants.



Shaffer Long Pull-Down Rotary Releasing Socket

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CUTTER

SPEARS For pulling casing or pipe, setting liners, for cut and pull jobs, for left-handing and holding, the Shaffer-Hamon Releasing Spear meets every requirement. Extra long slips and large wickered contact surface insure positive grip and prevent pipe distortion. Positive setting and releasing action safeguard every spear job. *Ask for further details!*

PIN TAPS The Shaffer Expanding Pin Tap is a valuable tool for backing off or left-handing a stuck drilling string when tool joint box or coupling is up, and small hole diameter excludes outside fishing tools. It is made up on the fish the same as an ordinary joint, but when operated binds the pin in the box so that the string must "break" at a joint somewhere below it. Easily released and reset whenever required. *Send for full information.*

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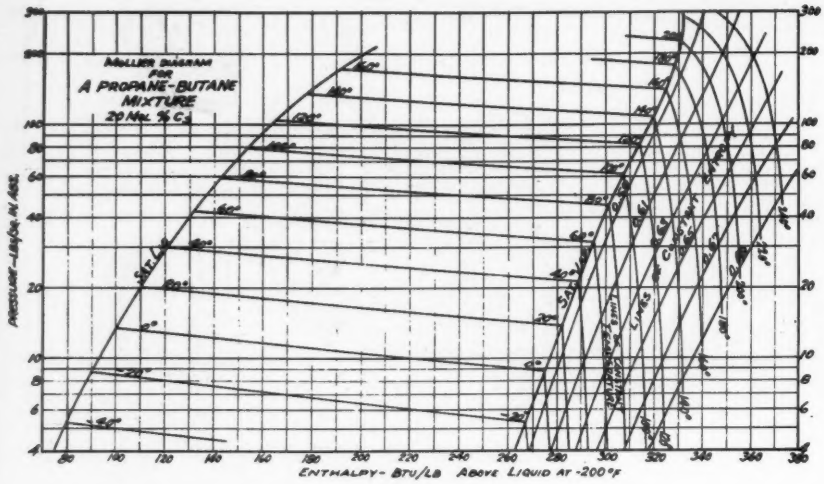

Figure 20

Mollier Diagram for a Propane-Butane Mixture (20 mol % C_3 — 80% mol % C_4). (Reference 20, see also Reference 3).

tions of this type are of considerable importance in designing a thermal cracking furnace because the phase condition and pressure drop affect the time of contact calculations.

ACKNOWLEDGMENT

The above discussion has covered many subjects. Contributions to our knowledge in this field have been made by many investigators. No attempt has been made to discuss these investigations in detail. Such a discussion would add materially to the length of this paper. Acknowledgment is made by including a list of literature references and by indicating on the cut line of the tables and figures where the work of others or previous publications of this author were used.

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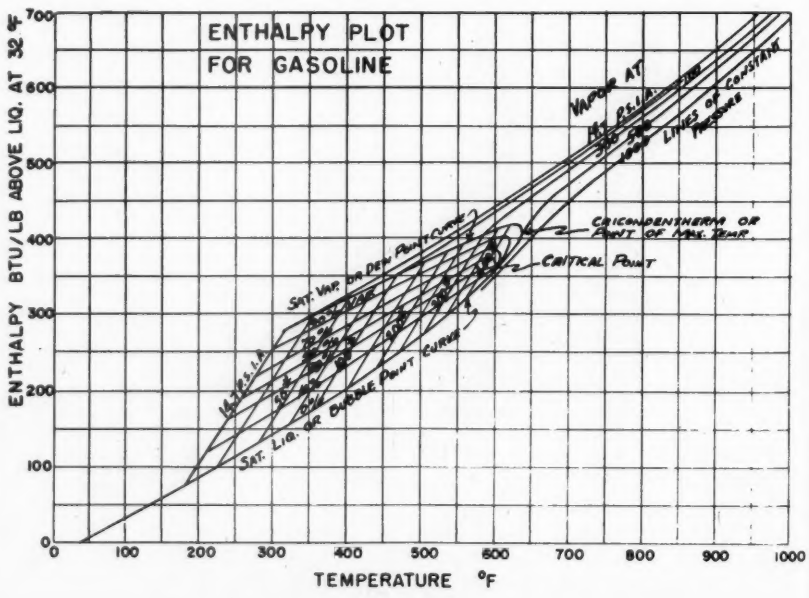
ENTHALPY PLOT FOR GASOLINE
ENTHALPY BTU/LB ABOVE LIQ. AT 32°F
TEMPERATURE °F
CRICONDENTHERM OR POINT OF MAX. TEMP.
CRITICAL POINT
SAT. VAP. OR DEW POINT CURVE
SAT. LIQ. OR BUBBLE POINT CURVE

Figure 21

Enthalpy Plot for Gasoline (See References 1, 9, 12, 14, 24, 33).

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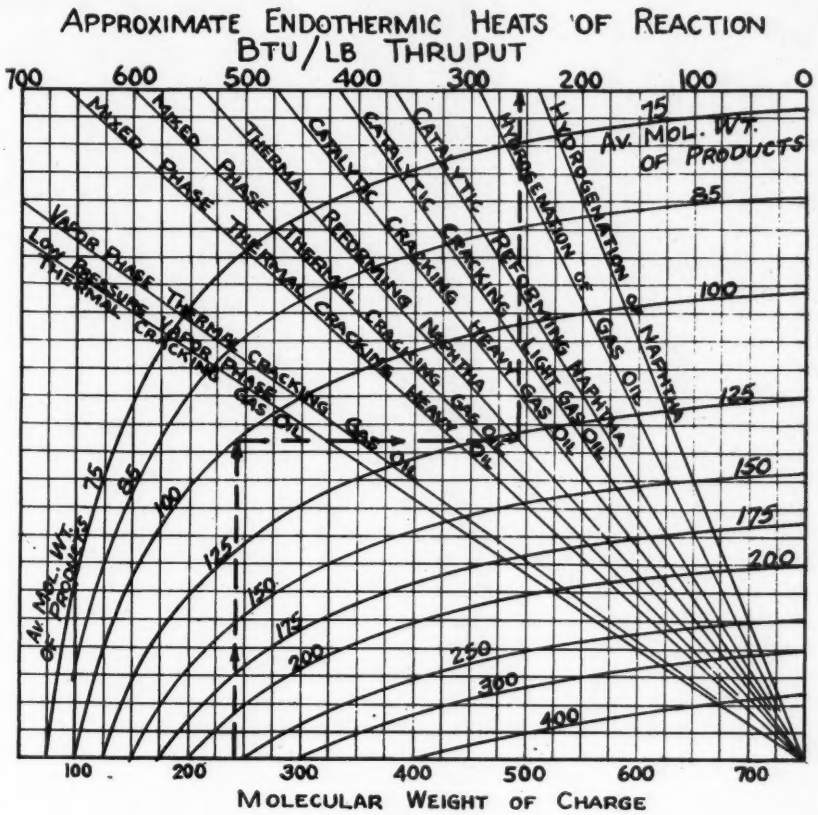

Figure 22
Approximate Endothermic Heats of Reaction.

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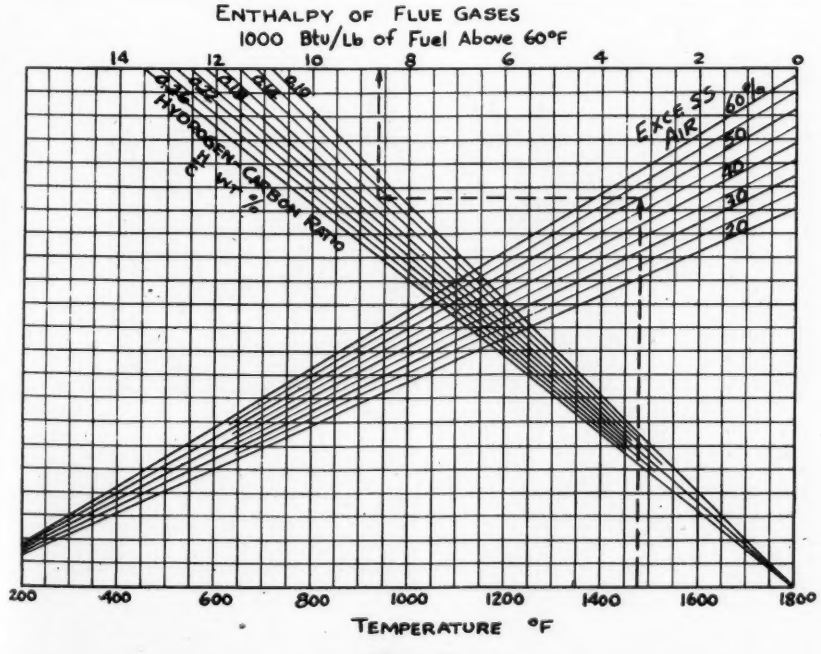


Figure 23
Enthalpy of Flue Gases.

This paper was delivered at the November, 1945, meeting of the California Natural Gasoline Association.

RECOVERS THAT "HARD-TO-GET" JUNK TOO ...AND FAST

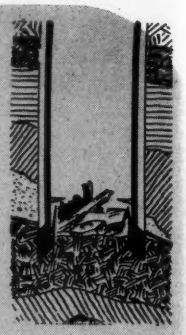
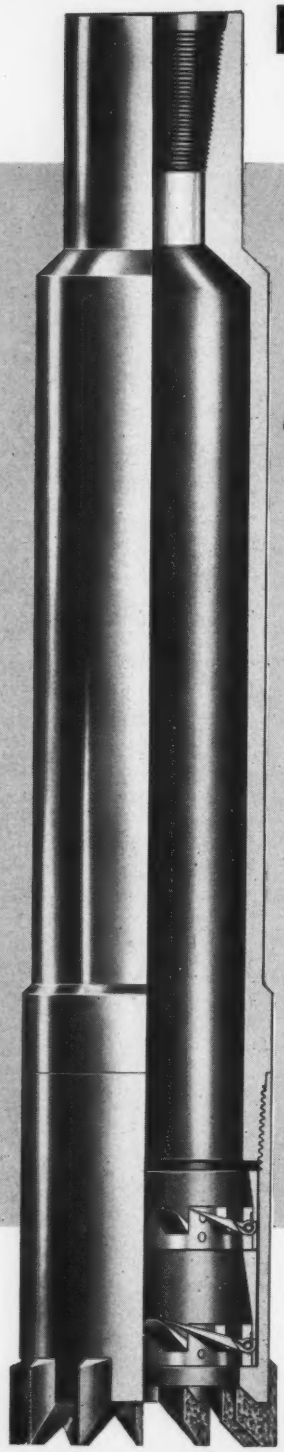


Fig. 1.

Here's why

Fig. 2.

Fig. 3.



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Perforation of Large Diameter Casing Solves Difficult Problem

An unusual job of pipe slotting has just been completed by the Oil Tool Corporation of Long Beach, California. The outstanding features of this operation are the size of pipe and the number of perforations. As can be seen in the accompanying illustrations, the slots are staggered in alternate rows with each double row containing 74 slots per circumference. The pipe is 11¾ inch, 45 lb. per ft., H-40 casing. The slots are 2½ inches in length by ⅛ inch in width and are spaced one inch apart circumferentially.

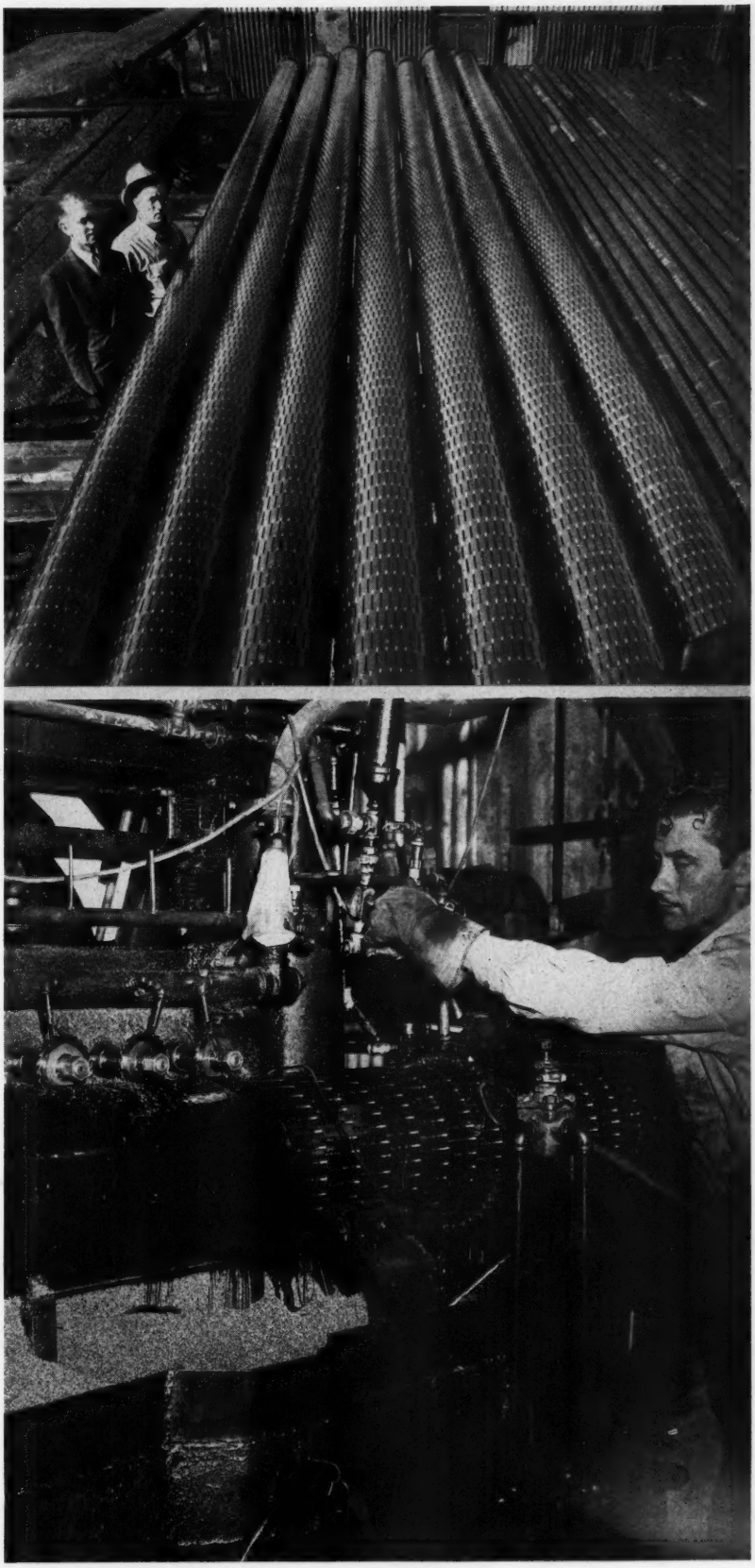
The pipe was perforated for the Camay Drilling Company for use in the Hawaiian Islands in accordance with the data contained in the following letter from Tyler F. Woodward, president of Camay:

"The perforated casing that you saw at the Oil Tool Corporation is going to the Island of Oahu in the Hawaiian group for a water well we are drilling for the California Packing Corporation. Water is quite a problem in the Hawaiian Islands as I understand, and considerable interest has developed due to the fact that we are drilling through volcanic rock, basalt, lava, etc. This material is very hard and abrasive, and due to the fact that the casing program on water wells usually requires a much larger interior diameter on casing, it is more than just a normal chore.

"Camay Drilling Company has two oil well rotary drilling rigs operating in the Hawaiian Islands at the present time. Both use conventional rotary drilling pipe, draw works, pumps, engines and masts. We are currently drilling a large deep hole for the Hawaiian Pineapple Company on the Island of Lanai in the Hawaiian group. This operation has penetrated a depth greater than any hole bored previously in that area. In fact, it has dwarfed any other water well drilling operation ever encountered in these volcanic islands.

"We have sent two crews to the Hawaiian Islands along with these

(Continued on Page 36)



A. P. I. Basin Chapter Holds Important Meeting

Talks by A. H. Bell, chairman of the Conservation Engineering Subcommittee of the Conservation Committee, and Capt. H. P. Stolz, US NR, before the war a member of the consulting firm of Stanley and Stolz, featured the recent meeting of the L. A. Basin Chapter of the A.P.I. Members who met at the Shell Recreation Hall, Signal Hill, also elected new officers of the Chapter.

Mr. Bell, who is general superintendent of the Continental Oil Co., described the methods of the Conservation Committee in apportioning crude production during the war, when the committee was made a part of the PAW organization, and what its present and future policy is to be; Capt. Stolz described the development and operation of the Elk Hills Naval Reserve, and its contribution to total California crude supplies under war-time demand.

The newly-elected officers of the Chapter are: Al Johnson of Shell Oil Co., chairman; Dave M. Anderson of Banning Estate, vice-chairman; Verne Sheppard of Eastman Oil Well Surveying Co., secretary-treasurer; and Ward Tennis of International Cementers, Inc., as assistant secretary-treasurer.

In opening his talk, Mr. Bell said that he thought it would clarify the present position of the Conservation Committee if the A.P.I. members had a clear understanding of oil industry-government organization and cooperation during the war, when the Conservation Committee, elected by operators in the various fields of the state, was drafted as a sub-committee of the Production Committee for District No. 5 and thus became a part of the Petroleum Administration for War.

The primary responsibility for allocation of California production during the war was in the Production Committee for District No. 5, Mr. Bell said. This committee functioned through two sub-committees, one of them the engineering committee and the other, the Allocation Committee of the Conservation Committee. The Production Committee's engineering sub-committee determined the maximum efficient rate of production for each pool in the state—the so-called "m.e.r."—and distributed the state quota determined by PAW to individual pools on the basis of the pool's m.e.r. The Allocation Committee then distributed the pool quota to the individual wells within the pool, all of these determinations subject to approval of the Production Committee for District No. 5 and the further approval of PAW headquarters in Washington.

With the end of the war, the PAW organization disbanded, thus returning the Conservation Committee to its former status of an elected, voluntary, industry-supported organization which took over when the PAW ceased to exist. The committee will continue to determine maximum efficient rates of production for California pools, based solely on engineering considerations to distribute the total production of oil thus determined to individual wells within pools, and to recommend to operators that they produce at that rate in order to avoid subsurface waste, Mr. Bell said.

To do so, the former Allocation Committee of the Conservation Committee has been reconstituted as the Conservation Engineering Sub-Committee, with a dual function. This committee has taken over the work of the engineering subcommittee of the former Production Committee for District No. 5, which was the determination of maximum efficient rates of production from pools, and of the former Allocation Committee of the Conservation Committee, which was to distribute the pool maximum efficient rate of production to the wells within the pool. Mr. Bell explained that in the latter function it was sometimes necessary for the committee to modify strict engineering considerations in order to preserve equity among producers, all of whom are entitled to a "living wage" from their wells.

No arbitrary action is taken by the Conservation Engineering Sub-Committee in setting up a pool m.e.r., Mr. Bell said. Whenever there is disagreement as to what it should be, the District Chairman, who is elected by the operators of the producing district each year and who, together with other district chairmen makes up the Conservation Committee appoints a Pool Engineering Committee, consisting of representatives of operators concerned, to make a study of the data and determine what, in their opinion, the pool m.e.r. should be. They then report their findings on a standard report form provided by the Conservation Committee for study and approval or disapproval of the Conservation Engineering Sub-committee. These reports have been standardized in order to assure interested companies that their own confidential data will remain confidential, Mr. Bell said. Meetings of the Conservation Engineering Sub-committee are open to interested operators, who may thus keep themselves informed as to the procedure of the committee in arriving at its final decision.

Operators are given an earlier opportunity to be heard in the establishment of the pool m.e.r., through the Pool Operators Committee, which is also appointed by the District Chairman, and which has authority and opportunity to make any comment on the recommendations made by the Pool Engineering Committee. The only thing that the Pool Operators Committee cannot do, in connection with the report of the Pool Engineering Committee, is suppress it, Mr. Bell said.

Throughout his talk Mr. Bell stressed the fact that the Conservation Committee, which consists of the 27 District Chairmen, and of

(Continued on Page 36)

Robert Harcus Foreign Representative; O. W. Morgan, Sales Manager, Oil Tool Division; Lynn Sawyer, Vice President and Manager of the Pump Division of Byron Jackson Co., Los Angeles.

B-J Officials Leave for Foreign Survey

Lynn Sawyer, Vice President and General Manager of the Pump Division of Byron Jackson Co., Los Angeles, accompanied by O. W. Morgan, Sales Manager, Oil Tool Division and Robert Harcus, Foreign Representative, left La Guardia Field, New York, on November 20, 1946, via Pan American Airways, for an extended visit in England and on the continent.

The purpose of their visit is to consult with hydraulic and petroleum engineers in England, France, Belgium and the Netherlands concerning future requirements for centrifugal pumps, submersible motors, oil well drilling and production tools.

Sawyer enjoys a wide acquaintance in the British Isles and on the continent, having previously spent considerable time in Europe for Byron Jackson Co. Morgan was Export Sales Manager before assuming Sales Management of the Oil Tool Division, while Harcus is a native of Glasgow, Scotland, and formerly Field Manager of the British Burmah Oil Co. in India.

Avery Van Campen, who for the past ten years has been employed by Clark Bros. Co. Inc., in their Experimental, Engineering and Sales Departments at Olean, New York, has been recently appointed to their New York sales office in the capacity of District Engineer. For the past three years, Mr. Van Campen has been job engineer on a National Defense Research Committee contract at Clark Bros. Company in Olean. He attended Yale University and is a member of the Yale Club of New York City.

Decker Returns from Sales Trip

E. L. Decker, Vice President of the Martin - Decker Corporation, Long Beach, Calif., has just returned from an extensive sales trip throughout the Mid-Continent and Gulf Coast territories. Mr. Decker attended the Oklahoma Contractors meeting and the Divisional Managers meeting of the Reed Roller Bit Company at Tulsa, Oklahoma. His itinerary included Shreveport, Louisiana; Houston and Fort Worth, Texas; Natchez and Laurel, Mississippi; Southern Louisiana and West Texas.

E. L. Decker

Tut Lee Joins Climax

H. W. Acason, Manager of the Western Division of Climax Engineering Company, has announced the appointment of Tut Lee as Manager of Oil Field Sales for Climax Engines and Parts Company, Los Angeles, Southern California distributor.

Tut Lee

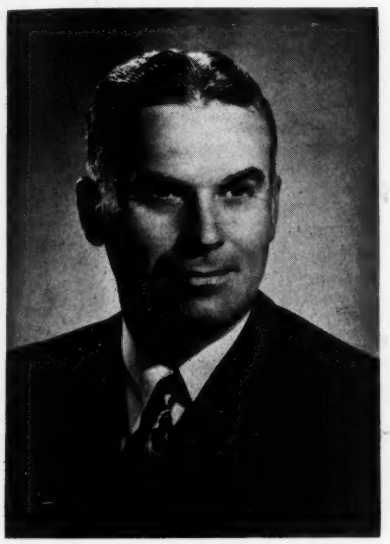
Mr. Lee has resigned from the International Derrick & Equipment Company, of Los Angeles, to become associated with Climax. He has a background of oil well drilling experience in the Mid-Continent, Rocky Mountain and California oil fields, and also in foreign service. Prior to being with Ideco, he was Manager of Sales and Service for the Regan Forge and Engineering Company of Los Angeles.

Being a member of the Los Angeles Chapter of Nomads, Mr. Lee has a wide acquaintance in the petroleum industry and will bring to Climax in California a thorough knowledge of the application of drilling and pumping engines for all oilfield service.

JORGENSEN
STEEL

Midco Tool, Subsidiary of Aireon Manufacturing Corp., Expands Plant

Expansion of the plant, facilities and the trade territory of the Midco Tool and Supply Co., of Oklahoma City, has been announced by Randolph C. Walker, president of Aireon Manufacturing Corp., Kansas City, which recently purchased the Midco Company.



William Bonner

At the same time Walker announced that William F. Bonner, general manager of Midco, and Dr. C. P. Bondurant, both of Oklahoma City, had been added to the board of directors. Other Midco directors are Walker, B. D. Craig and A. E. Welch, all of Kansas City.

Midco now furnishes equipment for most of the larger oil companies and independent drilling operators in the Mid-Continent area. Walker stated that the plant on SE 29th St. will be enlarged to about twice the present size and the manufacture of additional oil field equipment will be started. In extending the trade territory, the company will place representatives in Texas, Colorado and California. Outlets in the Illinois basin and the Mid-Continent area will be enlarged.

Bonner, who recently was named general manager, returned to Oklahoma City after about 25 years' absence; he is the son of "Mitch" Bonner, veteran Oklahoma oil operator. Raymond Lamb, long time with Midco, remains as assistant manager and will make headquarters in Oklahoma City.

Bonner joined Aireon in 1942 and was first contract administrator and later sales manager for the Burbank hydraulic division. In 1934, Bonner patented a chemical for the elimination of soot from steamship boilers and later organized the Sut Products Co. of which he is president and general manager.

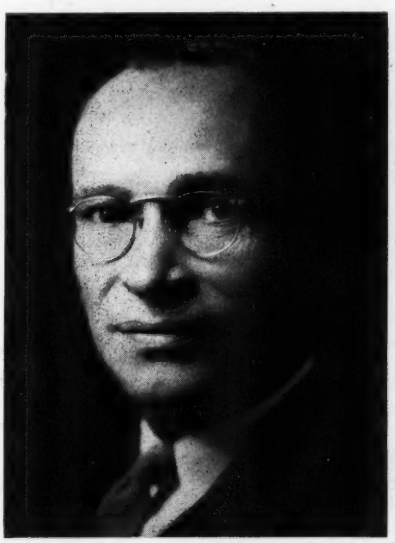
Former Californian Advanced by Socony-Vacuum

C. S. Teitsworth, vice-chairman of the manufacturing committee of Scony-Vacuum Oil Company, Inc., for the past five years, has been made chairman of that committee, it was announced recently.

He succeeds W. F. Burt, who has been made a vice-president and a member of the executive committee.

Mr. Teitsworth has been associated with Socony-Vacuum and affiliated companies for 19 years. Before transferring to the New York office of the company in 1934, he was associated for eight years with the General Petroleum Corporation, Los Angeles, Calif., where he was supervisor of process laboratories.

Prior to 1926, when he joined General Petroleum, Mr. Teitsworth was associated with the American Potash and Chemical Company, Trona, Calif.; Fixed Nitrogen Research Laboratory of the War Department, Washington, D. C.; the Celite Company, Lompoc, Calif., and the Dicalite ompany, Los Angeles, Calif.



C. S. Teitsworth

At the time of his transfer to New York in 1934, his specific assignment was to evaluate the commercial possibilities of catalytic cracking in Socony-Vacuum's refineries. He has been intimately associated with the development and commercialization of catalytic cracking since that time and is a director of the Houdry Process Corporation. In 1936 he was appointed to the manufacturing committee as manager for the company's mid-west refineries.

Mr. Teitsworth is a graduate of Stanford University with a degree in chemical engineering and he has performed graduate work at the University of Minnesota and the California Institute of Technology.

Mr. Teitsworth, who lives at 1301 Cushing Road, Plainfield, N. J., is married and has two sons. He is a member of the Plainfield Country Club and of the American Chemical Society.

Mr. A. R. Hauser succeeds the late John McClain as joint District manager of Clark Bros. Co. Inc., and Pacific Pumps, Inc., Chicago offices located at 122 South Michigan Avenue, Chicago, Illinois.
Mr. Hauser comes to his new duties after ten years of engineering service in the Engineering Department of Pacific Pumps, Inc., of Huntington Park, Cal. During his last three years with Pacific Pumps, he served in the capacity of assistant Chief Engineer. He will represent both of the above companies in the Chicago area.
Mr. Hauser is a graduate of the Chicago Technical College of Chicago, Ill.

18 years

OF OIL WELL SERVICE

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Top engineers say that Patterson-Ballagh products save oil well operators from 25 million to 50 million dollars a year. Every one of the 18 products introduced by Patterson-Ballagh in the last 18 years has been made to save wear and tear on costly drilling equipment. To prevent damage and accidents. To make drilling faster and smoother. Their cost is a very small fraction of the amount of money they save.

Wells are being drilled deeper and deeper. In many deep wells, the drill pipe being used today would fail unless Patterson-Ballagh Protectors were used.

Crews are making hole faster and faster. Formations that used to take years to cut through before 1927 now take only a fraction of that time. Patterson-Ballagh Casing Protectors help make this speed possible. When used at every joint in the string, table speeds are increased, while torque decreases.

Every Patterson-Ballagh product helps the operator, the tool-pusher and the drilling crew make greater progress; and their job simpler and easier. If there is a better way to do that job, Patterson-Ballagh will strive to find a way to do it. They hope to be of service to drillers everywhere for another 18 years and more.

A NEW PRODUCT EVERY YEAR SINCE 1927

The month of December, 1945, is Patterson-Ballagh's 18th birthday. In 1927, the need for protecting casing from tool joint wear was a No. 1 problem. This problem was solved 18 years ago with the birth of the rubber Casing Protector and Drill Pipe Stabilizer. Since then, these useful devices have been constantly improved. Their quality and usefulness have kept pace with other new drilling developments. During this period, Patterson-Ballagh has taken an important part in the great progress of oil well drilling. Seventeen new Oil Field Specialties were added to the line, and during the war PBX synthetic rubber was introduced. We are not stopping there! Watch Patterson-Ballagh for *new* products. Always *"Best Bet Yet"*... and *more to come.*

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Ever been stuck in the mud?
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2. *First* development of tools used in installing Casing Protectors.
3. *First* introduction of the long style Protector.
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7. *First* introduction of the Mud Gun.
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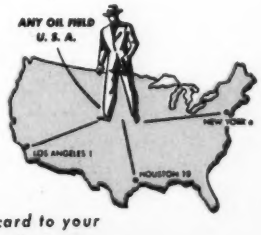
13. *First* introduction of the plastic Tubing Protector.
14. *First* introduction of the Dead Line Stabilizer.
15. *First* introduction of the Wire Line Wiper.
16. *First* introduction of the Sucker Rod Wiper.
17. *First* introduction of the Spiral Pump Packing.
18. *First* introduction of the Traveling Block Bumper.



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PATTERSON-BALLAGH
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OIL FIELD SPECIALTIES

Los Angeles Basin Chapter

(Continued on Page 30)

which Joseph Jensen of Tide Water Associated Oil Company is the present chairman, will concern itself only with the determination of efficient rates of production in order to assure the greatest possible ultimate recovery in light of engineering knowledge of today, and will not base recommended production rates on estimates of market demand or any other economic factor.

In concluding, Mr. Bell briefly reviewed the industry's production experience during the war, and expressed as his personal opinion that estimates as to the future at this time are subject to considerable skepticism. In considering future prospects, Mr. Bell listed as unknown factors the amount of future military requirements, the effect of increased population and consumption in California, the speed of rehabilitation of East Indies fields and their effect on California demand, and the degree of industrialization of China. On the supply side, Mr. Bell noted that future discoveries, average depth of approximately drilling up of old pools, rates of decline, methods of operation, and secondary recovery methods were all factors about which no absolute certainty could exist.

Capt. Stoltz told the A.P.I. members of the unit plan of operation between the Navy and Standard Oil Co. at Elk Hills, and also recited the course of development of the reserve when war-time demand made it necessary to supplement other supplies of oil in California. At the peak, Elk Hills produced 65,000 barrels per day, but since VJ day has been cut back to 15,000 barrels per day. In order to reach peak production, more than 300 wells were drilled to the shallow zone, at approximately 3000 feet, generally on the west side of the structure, Capt. Stolz said.

Present plans are that further exploratory efforts will be made to determine the edges of the structure, where its location is in doubt, and to determine the capability of the Stevens zone which lies at an 6000 feet. Experimental work will also be done to determine whether water-drive or gravity flow will result in greater ultimate recovery, and a gas injection program is also under consideration.

About 100 members of the Chapter, and their guests attended the meeting.

Perforation of Casing

(Continued from Page 29)

rigs and the entire operation is under the immediate supervision of Mr. Howard C. Christie, Vice President of the Camay Drilling Company. Mr. Sam M. Brooks, who has recently joined Camay Drilling Company as Vice President and Manager of Field Operations, keeps in constant touch with Mr. Christie and drilling activities by telephone and cable."

Piru Wildcat Runs Casing

C. W. Ginter & Associates have run 6⅝-in casing to 1380 ft. in Warring No. 1 in sec. 19-4n-18w near the town of Piru, Ventura County.

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Smith Introduces New Hole Opener

H. C. Smith Oil Tool Co., Compton, Calif., announces a new 6-point hole opener. The three rock bit gauge cutters and the three reamer cutters maintain six-point contact with the wall of the hole thus assuring full gauge to bottom. The gauge cutters are manufactured to the same specifications as the H. C. Smith Rock Bit cutters, including the triple bearing construction—an exclusive Smith development. The body is cast steel, scientifically designed and heat treated. Another important feature of the new H. C. Smith 6-Point Hole Opener is the box connection which permits the use of any type of rock or pilot bit.

Sperry - Sun Buys Houston Property

The Sperry-Sun Well Surveying Company has recently acquired by outright purchase the building and property at 3118 Blodgett Avenue, Houston, Texas, on which its present Gulf Coast headquarters are located.

The property comprises over two acres of land, allowing ample room for the expansion of the Sperry-Sun services which are planned during the near future.

The Houston office is the distributing center for all Sperry-Sun instruments and services used in the Gulf Coast and the Midcontinent. It has a well-equipped instrument maintenance and repair shop.

Mr. Roland Ring, Assistant to Sperry-Sun's Vice-President and General Manager, Mr. G. L. Kothny, is in charge of the Houston office.

Sperry-Sun is also establishing a new Research and Development Department in the suburbs of Philadelphia, where new equipment and new services will be developed and tested out prior to making the new equipment available to the Houston office for field tests. A number of new services for the drilling industry are today in the course of development in the research department.

A New, Fast and Accurate Method for the Interpretation of Surveying Records

The computation of the course of a bore hole from survey records obtained is a simple but also a long and tedious procedure. The mathematics involved are known to any high school student and offer no difficulty in their solution.

An accurate survey of a bore hole involves at least one hundred (100) or more records. The calculations to be made, based on these records, require considerable time. There is also the possibility of errors being made in such calculations, which may seriously affect the course of the hole to be determined.

To provide a speedy and accurate procedure to determine the course of a bore hole the Sperry-Sun Well Surveying Company has prepared a set of Tables which completely eliminate the making of calculations and immediately furnish the desired results. These Tables give the results for angles of inclination in quarter degrees from 0 to 31 and in half degrees from 31 to 45 and in degrees from 45 to 55 for bearing angles in degrees ranging from 0 to 90.

To obtain the result it is only necessary to refer to the Table, select the vertical column of angle of inclination and the horizontal column of bearing and obtain the Latitude, which is the distance North or South, and the Departure, which is the distance East or West from the vertical through the mouth of the well or from the vertical through the preceding point.

The Tables give the values of the Latitude and Departure for each one hundred (100) feet course length. They also give the true vertical depth for each angle of inclination. Geometric calculations are completely eliminated and only in cases where the course length is more or less than one hundred (100) feet it is necessary to multiply proportionately the values obtained from the Tables.

The Tables also contain a section dealing with the Correction of Magnetic Compass Records, a subject which is frequently overlooked when magnetic compasses are used for recording the angle of bearing. This section not only explains the influence of permanent magnetism of the bit and drill pipe upon the compass record obtained, but gives information for the determination of the strength of the magnetic field produced by a drill stem or drill bit and for the determination of the Angle of Correction.

These Tables have been prepared with great effort and expense by Sperry-Sun Well Surveying Company and have been used in their organization for many years. Sperry-Sun has received many requests for these publications and on account of their usefulness to the oil industry, Sperry-Sun has agreed to their publication. These Tables can now be obtained at the price of $5.00 per copy through the publishers of this magazine.

Field Development

PREPARED BY CALIFORNIA OIL WORLD NEWS SERVICE

Los Angeles Basin

Oil Discovery Looms In Buena Park Area

A new and important oil discovery is indicated in the initial performance of General Pet. Corp., Libroun No. 1 wildcat test, northwest of the town of Buena Park in sec. 21-3s-11w, Orange County.

The well flowed and swabbed 356 barrels gross in 24 hours. The oil was 26.5 gravity. The cut was 45 per cent, which reasonably may be wash water. Depth is 12,200 ft. with 7-in. shut off at 12,042 ft.

If the well is completed as a commercial producer, it will be the deepest oil well ever developed in the Los Angeles Basin.

Wilmington Well Flush Producer

On formation test of schist-conglomerate from 5863 to 5977 ft. underlying the regular zones in the Wilmington field, Long Beach Oil Dev. Corp., No. W-109 flowed 1440 barrels of 29.9 gravity oil per day rate, cutting 0.3 per cent through a ¾-in. bean, with 400 pounds flow pressure.

The well is bottomed at 5997 ft., with top of Conglomerate placed at 5870 ft. and top of Schist at 5950 ft.

Desert Wildcat Starts Drilling

Approximately 28 miles east of the town of Lancaster, Lehr Co. has started the drill in its scheduled shallow test in sec. 33-8n-8w in the Hi Vista area, with present depth in surface formations.

The Del Sur Oil Co., Del Sur No. 1 in sec. 26-7n-13w, six miles northwest of Palmdale, is coring ahead at 2187 ft.

Huntington Beach Wildcat Test Quits

Swabbed to 800 ft. Mohla Oil Co., Atha-SL.W.-Mohla No. 7-13 in sec. 13-6s-11w in the Huntington Beach area is being prepared for abandonment. Total depth is 3323 ft., with casing cemented at 1900 ft.

West Newport Work Increases

Macoil Co., which is drilling Banning No. 11 in sec. 20-6s-10w at West Newport at 1193 ft. and is preparing to pump Banning No. 32 from a plugged depth of 1936 ft., has made location for 9 new drilling jobs.

Banning No. 8 will go down in sec. 19-6s-10w, No. 20, 21, 24, 25, 34, 35, 37 and 38, in sec. 20 of the township.

Meanwhile, Sierra Trading Corporation has pulled out of its No. 2 in sec. 23 at a total depth of 3233 ft.

Dominguez Well Reaming To Test

Shell Oil Co., Inc., Dominguez Est. No. 1 in sec. 2-4s-13w in the Dominguez area is reaming to run formation test, as a sequel to an electric log survey and sidewall sampling. Depth is 8740 ft.

The company's Reyes No. 141 is drilling below 6250 ft. Union Oil Co. is rigging Callender No. 94. A 5th zone well, drill site is approximately 125 ft. west of No. 16.

Oak Canyon Try Making Progress

Western Gulf Oil Co., W. E. Stevens No. 1 in sec. 5-4n-17w in the Oak Canyon area in Los Angeles County is drilling steadily below 9050 ft. in hard shale.

Torrance Well On Production

Simmons Oil, Inc. has finished No. 14 at Torrance at a total depth of 3610 ft. for a yield between 40 and 50 barrels of 14.5 gravity oil a day. Thomas W. Simmons, Regent No. 1 is making ready to redrill. Bottom is 3568 ft.

Los Angeles City Test Suspended

After testing uphole to 1700 feet and last bailing 146 barrels of net 12.7 gravity oil in four days, Seaboard Oil Co., L. A. Brick No. 1 in sec. 21-1s-13w, one mile from the Los Angeles City Hall, has been suspended indefinitely. Total depth is 7505 ft., with plug at 1770 ft.

Del Valle Try Ready To Pump

Uinversal Consolidated Oil Co. is lowering tubing to pump its T. E. Adams-Aguirre No. 1 at the west end of the Del Valle field in sec. 13-4n-18w. Previously, the well was swabbed at a 75 barrels a day rate of 22 gravity oil. Total depth is 3169 ft. and 7-in casing is set at 2987 ft.

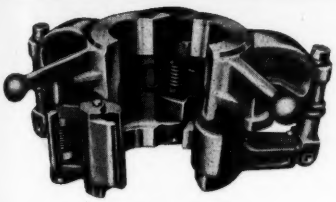
Leffingwell Wildcat Cores and Drills Ahead

Standard Oil Co. continues to carry on down its Lewis Comm. No. 1 wildcat test in the Leffingwell area east of Santa Fe Springs at a depth of 11,548 ft. in hard shale, without reported showings of oil or gas, since deepening from 10,635 feet.

Aliso Canyon Tests Continuing To Work

Wilshire Oil Co., Marquis No. 1 in sec. 35-3n-16w in the Aliso Canyon area is bottomed at 7700 ft., and is

"It's a Wilson"



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running electric log. In sec. 19, Standard Oil Co. is drilling and spot coring at 5679 ft. in Wigdal No. 1.

Bandini Wildcat Retesting Shoe

Richfield Oil Corp., U. P. Unit No. 1 in sec. 9-2s-12w in the Bandini area east of Los Angeles, which on test after being drilled out to 8563 ft., two feet below the shoe, flowed at a daily rate of 1300 barrels gross, with a 42 per cent cut, has been plugged to retest the shoe on the 8⅝-in. casing cemented at 8561 ft.

This try encountered the first oil zone near 7260 ft. and entered the Miocene at approximately 7450 ft. The sixth zone coring oil sand was 8390-8510 ft., then shale to 8658 ft., where the seventh zone was reached and cored to present bottom at 8608 ft.

Southeast of the U. P. project, Richfield is drilling Simons No. 1 in sec. 15 at 6116 ft. In sec. 21, C. C. M. O. Co., Bandini No. 1 is preparing to drill ahead from 6819 ft., after a stop for equipment repairs.

Exploration carried on thus far in the area by Richfield gives every assurance that a commercial oil field has been uncovered in an area which in recent years has been the scene of considerable test drilling, but evidently not to conclusive depths.

Del Valle Adds New Prospect Job

Transtate Oil Co. (Claude Kavanaugh, LeRoy Wilhite and Samuel D. Ruthoen) is grading roads for No. 1 well in sec. 8-4n-17w in the Del Valle area.

Federal Oil Co., Federal-Towle No. 1 in sec. 3-4n-17w is fishing casing to abandon at a depth of 5011 ft. A little heavy oil was swabbed.

Sunny Hills Test Fishing

On the Sunny Hills Ranch near the West Coyote field, Barnsdall Oil Company is fishing packer in its third test in the area, after the well was swabbed to 5240 ft. Drilled to a total depth of 6982 ft., and plugged back to 6500 ft., three intervals between 6370 and 6475 ft. are perforated. Drill site fall in sec. 21-3s-10w, Orange County.

Chino Hills "Cat" Still Making Tests

With bottom at 1520 ft. and 6⅝-in. casing set at 1459 ft. Chino Hills Oil Co. continues to test Kraemer-Backs No. 1 in the Chino Hills area in sec. 33-2s-8w, San Bernardino County.

Turnbull Test Drilling Ahead

A. W. Lyddon, Operator, Wm. Rowland Est. No. 3-1 in sec. 17-2s-10w in the Turnbull area, north of Whittier, is making hole ahead at 1609 ft.

Seal Beach Venture Redrills At 4100 Ft.

Marine Exploration Co., State No. 1 in sec. 11-5s-12w in the Seal Beach area, Los Angeles County, was last reported redrilling and coring at 4106 ft. T. P. Pike Drilling Co. is in charge.

Williams Area Test Grading

Southwest of the Williams field, Miller & York of Bakersfield are grading ground for Theta No. 2 in sec. 12-28s-19e, Kern County.

Coastal and Northern District

San Miguelito Yet Developing

In the San Miguelito field, Continental Oil Co. is cleaning out Grubb No. 38-2 in sec. 24-3n-24w at 7560 ft. Total depth is 9548, with 7-in. at 7760 and plug at 7699 ft. No. 41-2 is drilling at 3024 ft., No. 43-2 at 7750 ft. No. 42-2 and No. 40-2 are grading.

The Red Mountain wildcat, Casitas No. 2, is drilling ahead at 1514 ft. Location falls in sec. 7-3n-23w.

Los Alamos Test Drilling Shale

General Petroleum Corp., Los Alamos No. 3 in sec. 31-8n-33w in the Lompoc area is drilling hard shale at 4563 ft. Formation test of the interval 4367-4540 ft., open one hour, recovered 443 ft. oil and gassy mud.

Torrey Canyon Try Drills On

Oceanic Oil Co., No. 1 wildcat in sec. 32-4n-18w in the Torrey Canyon area of Ventura County is drilling ahead at 1360 feet. A substantial lease is held on Hunter Ranch property.

Carpinteria Test Plugs For Redrill

West of Carpinteria, Western Gulf Oil Co.'s Bryce No. 1 near the beach in sec. 30-4n-29w is redrilling at 2368 ft., a sequel to plugging back to 1919 ft.

Ojai Wildcat Flows Water

Volunteer Petroleum Corp., Hilltop No. 2 in sec. 7-4n-21w swabbed water, following a clean out job to 3680 ft. Previously, the well flowed salt water at a rate of 400 barrels a day. Total depth is 5211 ft., with 4¾-in. casing cemented at 4133 ft.

M. & L. No. 1, nearby, is idle at 245 ft.

General Pet. Spuds Glenn County Test

A dozen miles southeast of Willows, General Petroleum Corp. has spudded-in its Norman No. 1 gas test in sec. 5-18n-1w in the Packer Island area of Glenn County, with the drill last reported below 1500 ft.

Nearest established yield is Richfield Oil Corp.'s Afton Comm. No. 1-1 and No. 2-1 in sec. 34-19n-1w. These wells on test were good for 6200 MCF and 4500 MCF, each.

Arroyo Grande Well Standing Cemented

So. Calif. Petroleum Corp., Dollie No. 4 in sec. 6-32s-13e in the Arroyo Grande field, San Luis Obispo County, is standing with 8⅝-in. casing cemented at 762 ft. Total depth is 772 ft. in oil sand, which was topped at 762 ft.

This property was purchased some months ago by So. Calif. Petroleum from the Dollie Adams Oil Co. of San Luis Obispo.

Modelo Try Plugs Back

Pacific Western Oil Corp., Crocker Fee No. 1-D in sec. 7-4n-18w has been plugged back to 3680 ft. and is testing shut off on 7-in. casing cemented at 3570 feet. All trials on the lower part of the hole failed to measure up to commercial standards. Total depth is 10,504 ft.

Cat Canyon Adds New Producing Well

Union Oil Co. has completed Bell No. 10 in sec. 27-9n-33w in the Cat Canyon field, Santa Barbara County, pumping 507 barrels of net 14.8 gravity oil a day, cutting 10.6 per cent. Bottom is 5930 ft., with 8⅝-in. shut off at 5290 ft.

Palos Verdes Estates, Inc., P. C. No. 2 in the section is drilling at 4879 ft. in shale.

Rio Vista Area May Be Widened

In the Rio Vista area of Solano County, Standard Oil Co. is running formation test in its Cal. Pack No. 4 in sec. 36-5n-2e and is drilling Fontana Farms No. 4 in sec. 31-4n-1e at 4114 feet. West of Rio Vista production, Natural Gas Corp. Bacon No. 1 is making progress at 5776 ft.

Equipment is under repair on Amerada Petroleum Corp., Serpa No. 2 in sec. 24-4n-2e, with hole presently bottomed at 5474 ft. The Texas Co. is about to give the finishing touches to its Welch No. H-6 in sec. 6-3n-3e. Total depth is 5545 ft. The Green sand was topped at 3910 ft. and the Hamilton sand at 5217 ft.

Ventura Avenue Well Finished

Shell Oil Co., Inc., Taylor No. 229 has been completed in one of the lesser prolific zones at Ventura Avenue for 219 barrels of 29.4 gravity oil daily, along with 453 MCF. Total depth is 8200 ft., with 7-in. set at 7558 ft.

Tide Water Associated Oil Co. is grading for Hartman No. 40 and has rig up for Lloyd No. 113. Lloyd No. 145 is drilling sand and shale at 5258 ft.

Hopper Creek Test Drilling

Union Oil Co., Moran No. 1 wildcat in the Hopper Creek area of Ventura County in sec. 1-4n-19w continues to drill steadily ahead at a depth of 3220 ft.

Santa Paula Test Below 9100 Ft.

Standard Oil Co., Santa Paula Unit No. 1 in sec. 10-4n-20w in the Santa Paula area is getting deep. When last reported, operations were being carried rapidly ahead at 9132 ft.

Los Olivos Try Idle at 5852 Ft.

Following pump trials, which gave forth clear water and a little gas, Hub Oil Co., La Laguna No. 1 in sec. 7-7n-30w near Los Olivos, Santa Barbara County, is standing idle.

Located on the east edge of Los Alamos Valley, the test was credited with a number of oil showings, the best of which is around 4625 ft. The Monterey was topped at 3000 ft., Miocene 3380 ft. and bottom Cherty shale at 5520 ft.

San Joaquin Valley

Kern River Try Drills

Tide Water Associated Oil Co., Luck No. 54, a scheduled deep test to basement, is making hole ahead below 1350 ft. The well is sited in sec. 30-28s-28e.

San Emidio Well Drills

Western Gulf Oil Co., Los Lobos No. 1 in sec. 4-10n-22w is drilling at 5720 ft. in brown shale. San Emidio No. 2 in sec. 34-11n-22w landed 125 ft. of 5½-in. liner, including 15 ft. of 120 mesh perforated at 3081 ft., and on test swabbed salt water showing a scum of oil.

Paloma Area Industrious

Hogan Petroleum Co.'s Symons-Two No. 27-7 in sec. 7-32s-27e, the most southeasterly well in the Paloma field, is prepairng to test for production following gun perforating of the Symons zone at 10,061-971 and 10,001-994 ft.

The well was carried to a total depth and subsequently plugged back to 11,398 ft. when a substantial body of Paloma sand proved too tight to produce.

Lloyd Corp., Houchin No. 63-34 in sec. 34-31s-26e is drilling at 11,400 ft. in sand.

Ant Hill Field May Be Expanded

Seeking an easterly extension to the Ant Hill field, Amerada Petroleum Corp. has staked location for Waglay No. 27-14 in sec. 14-29s-29e, Kern County.

Rothschild Plans Gosford Venture

Rothschild Oil Co., Santa Fe Springs, has selected drill site for K.C.L. No. 56-12 in the Gosford area in sec. 12-30s-26e, Kern County.

General Petroleum Drills Tests Ahead

In the Fruitvale area, General Petroleum Corp., Calloway No. 66-17 in sec. 17-29s-27e is redrilling at 8545 ft. in shale. At Rosedale, Pioneer No. 83-26 in sec. 36-29s-26e is making hole at 9415 ft. in hard shale.

Schist Attracts New Prospecting

The Edison area of Kern County, the scene recently of a number of excellent producers completed in the schist zone, continues to attract new drilling.

East of the field, Independent Exploration Co. has location staked for Mettler No. 1, a wildcat test, in sec. 19-30s-30e. Des Moines Oil Co. has foundation in for Pauley No. 3 in sec. 16-30s-29e.

Union Oil Co.'s Rees No. 1 in sec. 14-30s-29e flowed 1073 barrels per day net 17.1 gravity oil in 21 hours, cutting 4 per cent through a 68/64-in. bean. Total depth is 2908 ft. Brockman No. 2a in sec. 13 is rigging up.

California Exploration Co., Porter No. 1 in sec. 17 is being placed on the pump. It swabbed oil on production test. Depth is 3950 ft., with 7-in. cemented at 3830 ft.

L. S. Gilmour, Operator, Kirk No. 1 in sec. 6 is coring at 4423 ft. in hard shale and gray sand. Some oil sand was logged immediately below 4358 ft.

The Texas Co., Hintz No. 1 in sec. 23 is drilling at 2454 ft. in schist.

Standard Adds Cymric Producer

Flowing initially 175 barrels of 31.1 gravity oil along with 200 MCF through a 48/64-in. orifice, Standard Oil Co., Weston No. 24-26 in sec. 26-29s-21e at Cymric has been finished at a total depth of 3660 ft. The 7-in. is cemented at 3200 ft.

Elsewhere in the area Union Oil Co.'s Anderson No. 54-26 in the section is making hole ahead at 3726 ft. in shale. On a formation test of the interval of 3551-3569 ft. recovery was promising. H. H. Magee, Operator, Bolton No. 2 in sec. 22 is drilling at 3965 ft. in shale.

Dumm Bros-Olympic Ref. No. 17, a westerly offset to the Independent-Exploration No. 1 discovery, is making progress below 3150 ft.

Cymric No. 1, sponsored by Independent Exploration Co. in sec. 21, was last reported bailing considerable oil, after landing liner at 2864 ft.

Reef Ridge Try Rigging Derrick

Southwest of Kettleman Hills production, Kings Exploration Co. is rigging up to start the drill in its Avenal No. 1 in sec. 18-23s-17e in the Reef Ridge area of Kings County. Holdings of the company embraces more than 600 acres.

Grapevine Test Coring Oil Sand

British-American Oil Prod., Tejon Ranch No. 41-5 in sec. 5-10n-19w near the Grapevine is coring at 2559 ft. in oil sand. A core from 2493 to 2549 ft. recovered tight clay with streaks of sand showing gas. A core at 2549-2559 ft. recovered a half dozen ft. of oil sand with faint cut at top and dark cut at bottom.

Kettleman Wildcat Point Of Interest

Standard Oil Co. is preparing to conduct formation test of oil showings cored between 9170 and 9194 fit in its No. 7-30V in sec. 30-23s-19e on the Kettleman Hills Middle Dome, which recently graduated in to the "no dope" category.

Standard may have picked up the zone found by the Petroleum Securities Burbank No. 1, which was completed at 9332 ft. in 1931 flowing about 1500 barrels of oil and 34,000 MCF gas a day, along with considerable water. After flowing for several days, casing split and the well was taken off production.

A series of ensuing mechanical troubles, which proved insurmountable, brought about abandonment of the venture six years ago.

Wilshire Enters Belridge Sector

Wilshire Oil Co. has staked location for Lehman No. 1 in sec. 18-28s-20e in the Belridge area. Contract has been let to Gene Reid Drilling Co.

In the Jacalitos area, Wilshire has quit its No. 56-22 as a produc-

tion failure at a total depth of 4469 ft.

North Premier Test Planned

Cinnabar Drilling & Exploration Co. has staked location for Cinnabar No. 17-Comm. No. 1 in the North Premier area, 200 ft. south and 1200 ft. west from center of sec. 17-26s-17e, Kern County. Arthur C. Fisher heads the company.

Round Mountain Project Barren

The Vedder was evidently gray and barren in Miller, York and Claire's K.C.L. No. 1 in sec. 13-28s-28e as the well has been abandoned. Total depth is 2397 ft. in gray sand, with top of the Vedder placed at 2390 ft.

In sec. 10-28s-28e, La Suna Oil Co. is making ready to begin operation in Heacock No. 3.

Santiago Area Still Develops

Western Gulf Oil Co., Woodward-USL No. 5 in sec. 22-11n-23w is coring at 2665 ft. in oil sand, top of which was placed at 2470 ft.

Richfield Oil Corp. has made location for Leutholz No. 4 in the section, and The Texas Co. is coring below 4500 ft. in Western Minerals Fee No. 2 in sec. 21.

General Petroleum Corp.'s Sunset No. 21A-1 in sec. 21 topped brown shale at 778 ft. and was last understood to be drilling in this body at 1180 ft.

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Raisin City Work Keeps On

Petrol Corp., No. 1-22 in sec. 22-15s-19e in the Raisin City area of Fresno County is making steady progress at 5174 ft. in shale. The best of showings encountered to present depth were between 4665 and 4695 ft. Jones No. 54-13 in sec. 13-15s-17e is runing 7-in. casing, with hole bottomed at 5251 ft. Oil sand was logged in the intervals of 4698-4711 ft. and 5052-5055 ft.

Chowchilla Wildcat Location Staked

Continental Oil Co. has staked location for Continental-Gulf-Miller & Lux Comm. No. 1 in sec. 25-11s-31e, south of Chowchilla in Madera County.

Meanwhile, Continental-Gulf, Chowchilla No. 1 in sec. 7-10s-14e has run tubing, after cleaning out to 8030 ft. Total depth is 8402 ft.

Hancock At Shale Hills

Hancock Oil Co. has staked location for Mabry No. 1 wildcat in the Shale area of Kern County in sec. 36-26s-18e. At Union Avenue, K.C.L. No. 1 in sec. 6-30s-26e is pumping 200 barrels of 15 gravity oil daily from total depth of 5346 ft.

WELL GEOLOGIST

To watch progress of wells in Eastern Venezuela. Care for samples, picks casing points, core points, etc. Write: Atlantic Refining Co., (Room 900) Box 7258, Philadelphia 1, Pa. 12/5b

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THIS LAUGH

OFF!!

Minister: "I made seven hearts happy today."

Parishioner. "How was that?"

Minister: 'Married three couples."

Parishioner: "That only makes six."

Minister: "Well, you don't think I did it for nothing."

Put a mama duck, a papa duck and five little ducks in a box and shake them up, what do you have?

A box of quackers.

After the honeymoon one of the bride's friends asked how the groom registered at the first hotel where they stopped.

Young Bride: "Oh—just fine."

"Tight clothing," offers Dr. Ling Po, "does not stop the circulation. The tighter the clothing," he continues, "the more a girl circulates."

She: "How did you get such a lovely expensive fur coat on your salary?"

Her: "Oh, I got it for a song."

She: "Looks more like an overture to me."

"What's the use of it all?" said the rooster, leaning his head sadly against the barn door. "Eggs yesterday, chickens today, feather dusters tomorrow."

Man is the only creature on earth that shortens his life by working hard in order to acquire things which will shorten his life still further.

Old Lady: "I suppose you and your husband worry a lot because you don't have any children after being married three years."

Young Lady: "Oh yes, we've spent many a sleepless night because of it."

"Do you neck?"

"That's my business."

"Ah, at last—a professional."

Sign in restaurant: "Waitress wanted. Will marry if necessary."

"I see you had a date with a driller."

"Oh, no, I tore my dress on a nail."

An evangelist recently announced there are 726 sins. He is being beseiged with requests for the list—mostly from people who think they must be missing something.

Revised, streamlined and modernized definition of an old man: "A guy who can't take 'yes' for an answer."

Pop, I got a licking in school today and it's your fault.

Yeah? How do you figure that.

Remember when I asked how much a million dollars is?

Yes.

Well, 'Helluva lot' ain't the answer.

When you get right down to the bottom of things, most oil men are just dame fools.

Then there was the K-9 Corps dog that asked for a "tree-day" pass.

" Waiter, I just simply can't eat this soup!"

"What's the matter with it?"

"No spoon."

Sounds in a Los Angeles theatre: "Hands off, Columbus. You've discovered enough for tonight."

Brown: "Did I tell you about the awful fright I got on my wedding day."

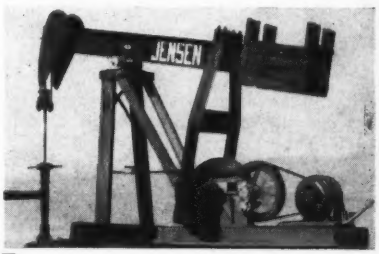
Black: "Careful, no man ought to speak like that about his wife."

"Why do you want a new trial?"

"On the grounds of newly discovered evidence, your honor."

"What was the nature of it?"

"My client has dug up $400 I didn't know he had."



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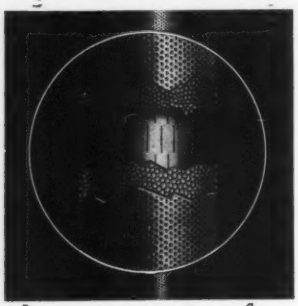

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The Lucey Products Corporation of Tulsa, Oklahoma, announces the purchase from Reconstruction Finance Corporation, the oil well drilling equipment and machinery on R.F.C. special listing L.A. No. 2, known as New Zealand Surplus, and have opened offices and warehouse at Basich Brothers Construction Company's yard at 600 So. Fremont Avenue, Alhambra, California.

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Brown-Bevis Adds To Sales Staff

Chas. E. Sell, formerly with both the Lang Company and the Lund Company, Salt Lake City, and before that in charge of the maintenance of construction equipment for the Idaho State Highway Department, has been added to the sales force of Brown-Bevis Equipment Co., 4900 Santa Fe, Los Angeles. During the war Mr. Sell was employed by the Ninth Service Command working on gun control instruments as Foreman of Ordnance Repair of Army Vehicles in Los Angeles, and for about a year he was in charge of setting up Auto Repair Shops on the China-Burma-India front for operation of the Lido-Burma Road. This experience he sums up by saying that he had a good chance to see how machines were used and abused.

Brette Brown, who will specialize on gasoline and diesel engines, electric motors, and related items, started with Brown-Bevis on December 4th. Mr. Brown, not related to the original Brown in Brown-Bevis, comes to the organization from sales work on tools of all kinds with Keystone Tool & Supply Co., Western Tool & Engineering Co., and a course in Mechanical Engineering at the College of Pacific.

Herb Matthews, formerly master mechanic and service manager of Tri-State Equipment Company, Memphis, Tenn., has joined the Brown-Bevis Equipment Company as Field Service Specialist. Herb has had years of experience on a variety of construction jobs, particularly heavy equipment, and will be able to get Brown-Bevis equipment into action quickly and to keep it operating efficiently on the job.

Long Canyon Test Continues Inactive

Shell Oil Co., Inc., McBean No. 1 in the Long Canyon area of Ventura County, which has been standing idle for several weeks at 10,549 ft., remains inactive. The area under test is not far from Moorpark.

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Shiells Canyon Deepening Job

John Schumacher, Los Angeles independent operator, is preparing to deepen Calumet No. 1 in the Shiells Canyon field, Ventura County. The Texas Co., Shiells No. 157 is rigging pump, after swabbing sand with a trace of oil. Depth is 2744 ft. with casing set at 2335 ft.